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Clayton GROUP SERVICES

VIA OVERNIGHT DELIVERY

October 29, 2004

Mr. Kevin Turner
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Clayton Project No. 15-03095.15-001

Subject: **ILR000128249 – Madison County – LPC 1190505040**
The Hartford Area Hydrocarbon Plume Site /
Hartford, Illinois
Free-Phase Hydrocarbon Investigation Report

Dear Messrs. Turner and Faryan:

Clayton Group Services, Inc., on behalf of the Hartford Working Group (HWG), and in accordance with paragraph 45 of the Administrative Order on Consent, is submitting the Free-Phase Hydrocarbon Investigation Report. This report presents the results of the FPH field investigation to confirm and supplement the CPT/ROST investigation completed earlier this year. Within the context of this investigation, free phase hydrocarbon is meant to mean light non-aqueous phase liquid (LNAPL) or separate phase hydrocarbon.

We believe that the results of the investigation demonstrate that the lateral extent of the free-phase petroleum hydrocarbon (LNAPL) plume within Hartford has been largely defined. The extent correlates well with the interpreted extent based on our evaluation of the CPT/ROST investigation. These results, in addition to other information being gathered, will be used in the development of the proposal for an active recovery system.

15-03095.10ca067 / MMN

Please contact me with any questions.

Sincerely,

Monte M. Nienkerk

Monte M. Nienkerk, P.G.
Senior Project Manager
Environmental Services

Encl: Free-Phase Hydrocarbon Investigation Report

cc: Hartford Working Group
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Free-Phase Hydrocarbon Investigation Report

Volume 1: Text, Figures and Graphs

1190505040 -- Madison County -- ILR000128249
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Prepared for:
THE HARTFORD WORKING GROUP
Hartford, Illinois

Clayton Project No. 15-03095.14.006
October 29, 2004

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Free-Phase Hydrocarbon Investigation Report

Volume 1: Text, Figures and Graphs

1190505040 -- Madison County -- ILR000128249
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

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EXECUTIVE SUMMARY

As part of on-going activities, being conducted in the matter of The Hartford Area Hydrocarbon Plume Site, Clayton Group Services, Inc. (Clayton) was retained by The Hartford Working Group (HWG) to prepare this Free Phase Hydrocarbon (FPH) Investigation Report (FPH Report) of Hartford, Illinois (Hartford). The work was conducted to establish the extent of free phase hydrocarbons and better define the stratigraphy underlying Hartford, Illinois. Free phase hydrocarbon is defined as Light Non-Aqueous Phase Liquid (LNAPL) or separate phase hydrocarbon. The HWG is comprised of the Atlantic Richfield Company (Atlantic Richfield), The Premcor Refining Group Inc. (Premcor) and Shell Oil Products US (Shell).

The lateral extent of the LNAPL plume within Hartford has been defined by this investigation. The extent correlates with the interpreted extent based on the evaluation of the 2004 CPT/ROST™ investigation results.

The CPT/ROST investigation along with the soil boring completed with this investigation also provided information to aid in the interpretation of the subsurface geology. Based on these data, a heterogeneous alluvial veneer of silts and clays overlies the areally extensive Main Sand underlying Hartford. Three, local, more permeable units, the North Olive, Rand and EPA Strata, are found within these overlying alluvial deposits.

The North Olive Stratum is found at depths ranging from 8 to 16 feet below ground surface (bgs) at an average elevation of 419 feet mean sea level (MSL). The thickness of the North Olive varies from 0 to approximately 10 feet with an average thickness of approximately 4 feet. The average grain size of the North Olive is primarily silt with clay and some sand.

The Rand Stratum is present at depths ranging from 12 to 24 feet bgs at an average elevation of 410 feet MSL. The thickness of the Rand ranges from 0 to approximately 12 feet with an average thickness of approximately 6 feet. The average grain size of the Rand is also primarily silt with clay and some sand.

The EPA Stratum has been found only beneath the northeast section of Hartford. It is encountered from approximately 30 to 34 feet bgs at an average elevation of 399 feet MSL. The thickness of the EPA stratum ranges from approximately 5 to 8 feet thick with an average thickness of approximately 7 feet. The average grain size of the EPA Stratum consists of sand with silt and some clay.

In the approximate north central portion of Hartford, the three above named strata merge into the Main Sand. The Main Sand is present as shallow as approximately 9 feet bgs in the south end of northern Hartford at an elevation of approximately 422 feet MSL and as deep as approximately 45 feet bgs in the northeast section at an elevation of approximately 385 MSL. The average depth to the Main Sand is 25 feet bgs. The average grain size of the Main Sand consists of sand with silt and some clay.

Grain-size analysis of the less permeable strata, overlying and intervening between the North Olive, Rand and EPA Strata, identified the deposits predominantly as clay with the average grain-size being clay with silt and some sand.

Nested monitoring probes wells were installed in the named more permeable strata to delineate the extent of the identified LNAPL plume underlying Hartford and to validate the interpretation of the CPT ROST identified LNAPL plume. Replacement soil vapor extraction wells for the Hartford Vapor Control System Upgrade were also installed at this time. In April 2004, Clayton observed sewer replacement, conducted by the Village of Hartford on East Watkins Street, and observed apparent petroleum residue in the sewer main. During 2003, Clayton also observed petroleum pipeline replacement activities,

conducted by Premcor, on Elm Street. Chemical analysis revealed that petroleum hydrocarbons were present in the soils throughout Hartford. The hydrocarbons include benzene, ethylbenzene, toluene and xylenes (BETX), semi-volatile organic compounds (SVOCs) and polynuclear aromatic hydrocarbons (PNAs), a subset of SVOCs. The BETX concentrations ranged from 10^{-1} to 10^{6} µg/kg while the SVOCs levels ranged from 10^{2} to 10^{4} µg/kg. The detected PNAs ranged from 10^{1} to 10^{5} µg/kg. MTBE, a blending component in gasoline, was not detected above reporting limits in any of the samples.

Lead and other metals, which are naturally occurring constituents in soil, were also identified. Lead concentrations did not appear to have a correlation to the LNAPL identified in Hartford.

From May through September 2004, the Main Sand groundwater flow direction was consistently to the north with varying east/west components. This is consistent with historical observations. The observed easterly component was most pronounced when the stage of the Mississippi River was over 410 feet MSL. In July and September 2004, the groundwater flow in the EPA Stratum, underlying Hartford, was generally southwesterly. The July 2004 EPA Stratum flow map also indicated a groundwater divide, with an east/west axis, located slightly east of the northeast corner of Hartford. The flow north of the divide was generally northerly, while the flow to the south, as stated above, was southwesterly.

The July 2004 Rand Stratum groundwater flow direction, north of Rand Avenue, was generally northeasterly while the September 2004 flow direction, south of Rand Avenue was southwesterly. The flow patterns may, in part, be an artifact of gauging different well sets during the two events or indicate a naturally occurring groundwater divide or a groundwater divide caused by groundwater usage (pumping) in the Main Sand. A similar groundwater divide has been observed in the EPA Stratum. Groundwater was not

observed throughout the entirety of the Rand Stratum in September 2004. The North Olive Stratum was found to only contain scattered, localized areas of perched water.

In September 2004, the Main Sand LNAPL plume extent was generally bounded as follows:

- Rand Avenue to the north;
- North Olive Street to the east;
- East Watkins Street to the south and;
- Old St. Louis Road to the west.

The LNAPL plume extent was found at depths of approximately 29 to 33 feet bgs and elevations ranging from approximately 401 to 398 feet MSL. The largest Main Sand apparent separate phase hydrocarbon thickness (>2 feet) was observed on the eastern side of Hartford, proximate to both the Elm Street and North Olive Street petroleum pipeline corridors.

Small, apparently localized, LNAPL plumes were found in both the EPA and Rand Strata with one in the EPA and two in the Rand. The separate phase hydrocarbon within the EPA Stratum was present in the northeastern corner of Hartford at 27.5 feet bgs (401.6 feet MSL). The Rand Stratum also contained two localized areas of separate phase hydrocarbon, one also present in the northeastern corner of Hartford and encountered at depths ranging from approximately 14.7 to 22.6 feet bgs (414.5 to 406.8 feet MSL). The second, little more than a sheen, was south of East Elm Street, previously at depths of approximately 26.2 to 27 feet bgs (403.3 to 404.1 feet MSL). The separate phase hydrocarbon in the EPA Stratum and the northernmost area of the Rand Stratum are both proximate to the Rand Avenue petroleum pipeline corridor.

Simulated distillation analysis of the separate phase hydrocarbon, along with density and kinematic viscosity analyses, identified apparent gasoline range separate phase hydrocarbon

in the Main Sand along with apparent gasoline/diesel range mixture separate phase hydrocarbon in samples obtained from the east and north sides of northern Hartford. Apparent diesel range separate phase hydrocarbon was found in samples from the Rand and EPA stratum in the northeastern portion of Hartford.

The presence of residual petroleum hydrocarbons, both within the North Olive Stratum and within certain utility corridors of Hartford, such as the sewer main on East Watkins Street, supports the initial Conceptual Site Model. The presence of separate phase hydrocarbons in the utilities was identified as a potential source for vapor intrusion. The presence of shallow, more permeable strata (such as the North Olive Stratum) further serves as another potential pathway for vapor intrusion. Vapors emanating from petroleum hydrocarbon sources located in deeper strata could preferentially migrate laterally within the shallow strata. The largest measured separate phase hydrocarbon thickness in the Main Sand, along with the separate phase hydrocarbon identified in the EPA and Rand Strata, all being near a petroleum pipeline corridor, point to the petroleum pipelines as primary sources of the identified separate phase hydrocarbon. This observation is supported by soil analytical data with the highest concentrations of petroleum hydrocarbons being in or proximate to the pipeline corridors. Furthermore, the ROST investigation found the shallowest residual petroleum was proximate to the petroleum pipeline corridors, primarily the North Olive and Rand Avenue corridors.

1.0 INTRODUCTION/PURPOSE

Paragraph 50 of the Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (U.S. EPA) in the matter of The Hartford Area Hydrocarbon Plume Site (Docket No. R7003-5-04-001) requires the preparation of this Free Phase Hydrocarbon (FPH) Investigation Report (FPH Report) of the Village of Hartford, Illinois upon completion of the *FPH Monitoring Well and Soil Sampling Plan* (FPH Plan) included in the *FPH CPT/ROST™ Subsurface Investigation Report* dated April 8, 2004 (ROST report). Clayton Group Services, Inc. (Clayton) was retained by The Hartford Working Group (HWG) to prepare the FPH Report. The HWG is comprised of the Atlantic Richfield Company (Atlantic Richfield), The Premcor Refining Group Inc. (Premcor) and Shell Oil Products US (Shell).

The investigation consisted of the installation of nested monitoring probes/wells at multiple locations within Hartford, Illinois (Hartford). The purpose of the investigation was to delineate the extent of the known free-phase petroleum hydrocarbon plume underlying Hartford. Free-phase petroleum hydrocarbon is defined as Light Non-Aqueous Phase Liquid (LNAPL) or separate phase hydrocarbon.

Drilling activities were primarily conducted within existing streets and alleyways in Hartford within the limitations posed by public access right-of-ways and associated utilities. New soil vapor extraction (HSVE-series) wells, designed to replace the existing vapor control boring (VCB) wells as part of the Hartford Vapor Control System (VCS) Upgrade, were also installed at this time. The VCS is discussed further in Section 2.2.

The work was conducted as discussed in the FPH Plan, the *Technical Memorandum Vapor Control System Upgrade Design*, dated May 6, 2004 and the *Response to U.S. EPA Letter dated June 2, 2004, Regarding Comments to ROST Investigation Report and*

Work Plan to Messrs. Kevin Turner and Steven Faryan of the U.S. EPA, dated June 21, 2004. All of these documents were prepared by Clayton on behalf of the HWG.

To enhance the understanding of subsurface conditions in Hartford, Premcor, has provided data from petroleum pipeline replacement activities along Elm Street in 2003 that has been incorporated in this document. In addition, ENSR Corporation (ENSR), working in cooperation with Clayton on behalf of the HWG, has also provided information obtained as part of their concurrent investigations in Hartford. Finally, observations of a sewer main replacement, completed by the Village of Hartford, on East Watkins Street have been included.

It is important to note that this document presents the results of the FPH Plan field investigation to confirm and supplement the completed CPT/ROST investigation. It presents known information and data available at the time of preparation of this report. The CSM could change based on results from any additional site characterization studies.

The Hartford site boundaries have been defined in the AOC as being bounded by Rand Avenue to the north, the nearest railroad tracks to the east side of Olive Street to the east, Donna Drive and the south boundary of Hartford Park to the south, and Illinois State Highway 3 to the west. The general location of Hartford, Illinois and the site boundaries are presented in Figure 1-1. The Hartford site boundaries may differ from the Hartford corporate boundaries.

2.0 SITE DESCRIPTION

2.1 LOCATION

Hartford, Illinois is located in Madison County on the east bank of the Mississippi River upstream from St. Louis, Missouri. Hartford lies approximately 3,000 feet east of the Mississippi River. The Shell Tannery Property and the Premcor facility are located directly east of Hartford. The BP Amoco (fka Amoco) facility lies north-northeast of Hartford across Rand Avenue. The ConocoPhillips facility (former Shell facility) is located east of the Premcor facility. Figure 1-1 shows the respective property boundaries of these facilities and their geographical relationship to Hartford.

2.2 SITE HISTORY

A historical summary of environmental concerns in Hartford was most recently presented by Clayton (2004a). In general, the concerns have been located within an area bounded by Hawthorne Street to the south, North Olive Street to the east, Illinois State Highway 3 to the west, and Rand Avenue to the north (Figure 2-1). Numerous underground petroleum pipelines are present in the area with those in the northern portion of Hartford located in three corridors, the Elm Street corridor, the North Olive Street corridor and the Rand Avenue corridor.

Odor issues, dating back to May 1966, have been documented in buildings located in the northern portion of Hartford. In 1978, investigations were conducted because of a series of residential house fires and building odor complaints. The investigations identified the presence of a LNAPL plume beneath the northern portion of Hartford.

In 1978 and 1979, Clark Oil Corporation (Old Clark), the former owner and operator of the Premcor facility, installed two wells in Hartford to recover separate phase

hydrocarbon. In 1992, Premcor (then known as Clark Refining & Marketing, a different company than Old Clark) installed a Vapor Control System (VCS) in the northern portion of Hartford to further address the identified problems. The VCS was designed as a soil vacuum extraction (SVE) system, an established remediation technology, to extract vapors from the unsaturated zone, where residual hydrocarbons are present and from the top of the separate phase hydrocarbon floating on the groundwater. Premcor also installed a third product recovery well in Hartford in the early-1990s. One new soil vapor extraction well (HSVE-1) was also installed by Premcor in January 2004 as part of a pilot test (Clayton 2004b). The locations of the separate phase hydrocarbon recovery wells and the wells (VCB- and HSVE-series) associated with the VCS and the pilot test are shown in Figure 2-1.

2.3 PHYSICAL SETTING

The geologic and hydrogeologic setting of this area has been presented in detail by Clayton (2004a). The geographical region around Hartford and other nearby towns is collectively known as the American Bottoms, a shallow valley 30 miles long and 11 miles across at its widest point.

The present landscape and the upper 130 feet of the Hartford area were created by alluvial and glacial processes during the last 125,000 years. The Mississippi River, the dominant creator of this landscape, frequently changed its course during the Pleistocene period. During this period, the valley was filled with sandy glacial outwash known as the Mackinaw Member of the Henry Formation. The Mackinaw sands range from 60 to 150 feet in thickness and comprise what is known as the Main Sand which is the deepest and thickest unconsolidated aquifer (Main Sand Aquifer) underlying the area of Hartford. The upper portion of this aquifer consists primarily of fine-grained sand. The Main Sand Aquifer is the primary source for large-quantity water production in the area.

Natural groundwater movement beneath the American Bottoms is westerly, draining from the limestone bluffs (east wall of the valley) located east of Hartford, to the Mississippi River. However, for the past 70 years, the natural movement of groundwater has been altered in the Hartford vicinity due to large-scale industrial water pumpage. Known cones of depression flank the village to the north (BP Amoco) and northeast (ConocoPhillips). In general, the net effect of this drawdown has resulted in local groundwater movement in the Main Sand Aquifer to the northeast.

The uppermost geologic unit overlying the Main Sand is the Cahokia Alluvium of Holocene Age, which consists of sands, silts, and clays of floodplain, channel, and modern river origin. In recent times, the migration of the Mississippi River across the bottomlands has reworked the upper part of the valley fill, while spreading floodwaters deposited silt and clay along the sides of the channel and in backwater areas. The channel migration, cut-and-fill, and flooding have produced complex heterogeneous deposits.

The primary findings of a Clayton (2004c) cone penetration testing (CPT) subsurface investigation in early 2004 revealed the presence of a heterogeneous alluvial veneer of silts and clays overlying the areally extensive Main Sand. The alluvial silts and clays generally thickened across Hartford in an easterly direction. A similar thickening occurred in a northerly direction. Three more permeable units, locally known as the EPA, Rand and North Olive Strata, were found within these deposits. The three strata exhibited significant spatial variability, based on the CPT data, ranging from sand with clay and silt to silt with sand and clay. The units were separated by less permeable silty clays and clayey silts.

The EPA Stratum, which overlies the Main Sand, has been found only beneath the northeast portion of Hartford. Sequentially, above the EPA Stratum and more widespread throughout the northern portion of Hartford, were the Rand and North Olive

Strata. In general, the groundwater flow direction in the Rand and EPA Strata has historically been identified as northeasterly while the groundwater flow direction in the North Olive Stratum has not been defined.

In Hartford, to the south of Watkins Street, the intervening less permeable units pinchout and the four strata (Main Sand, EPA, Rand and North Olive) combine into one hydrostratigraphic unit identified as the Main Sand. The exact extent and continuity of these relatively thin strata overlying the Main Sand throughout Hartford remain somewhat uncertain because of geologic heterogeneities related to the depositional environment of the area. The Mississippi River, located approximately 3,000 feet west of Hartford, is hydraulically connected to the Main Sand Aquifer and is believed to potentially be connected to the remaining overlying strata, dependent upon river stage. Since the river stage can vary up to 20 feet during a year, these strata may vary from unconfined to confined conditions during the year.

3.0 LNAPL SUBSURFACE INVESTIGATION

Subsurface investigation activities conducted from July through September 2004, included Geoprobe® and hollow-stem auger (HSA) borings, chemical and geotechnical soil analyses, monitoring probe/well installations, soil vapor extraction (SVE) well installations, monitoring probe/well gauging, bail-down tests and separate phase hydrocarbon simulation distillation analyses. Each of these activities is discussed below. This section also includes a discussion of excavations conducted on Elm Street in 2003, by Premcor, and on East Watkins Street in April 2004 as part of a sewer replacement by the Village of Hartford. The SVE wells were installed as part of the upgrade of the existing VCS. The probes/wells are intended for uses including gauging, obtaining separate phase hydrocarbon and/or groundwater samples, and evaluating the VCS upgrade.

3.1 SOIL BORINGS/GEOPROBES®

In July and August 2004, as part of the VCS upgrade and the LNAPL investigation, Clayton completed soil borings at 54 locations in Hartford for the installation of nested monitoring probes (MPs) and monitoring wells (HMWs) and the installation of replacement vapor control borings (HSVE series wells) (Figure 2-1).

The MP-series installations had two purposes. The original, and primary purpose, was to sufficiently screen the named, more permeable strata (e.g., North Olive, Rand, EPA and Main Sand) to enable the determination of potential vacuum influence, resulting from operation of the VCS, within these strata. The secondary purpose was to sufficiently screen the named strata to enable the determination of the presence or absence of water and separate phase hydrocarbon within these strata with the goal of establishing the horizontal and vertical extents of the LNAPL plume. In some instances, field conditions resulted in a final well placement that differed from the design placement. For example,

MP-47C was inadvertently pulled up approximately 4 feet during installation resulting in the well straddling the overlying silty clay and the Main Sand. An evaluation indicated that the probe would still meet the design purpose. In other cases, based on the observed field conditions, a probe was designed to span beyond the identified stratum. Specifically, MP-39A was designed to screen the North Olive Stratum and the contiguous overlying permeable fill as the primary intent of the probes was to evaluate the effectiveness of the Hartford VCS within the more permeable strata.

A review of probe installations during the investigation revealed that, in general, the shallowest of the nested probes at each completed location had a top of screen near ground surface (e.g. 10 feet bgs or less). However, in several locations (MP-31, MP-33, MP-35, MP-44, MP-50, MP-51), a review of the stratigraphy revealed the shallow North Olive Stratum, if present, was notably deeper than approximately 10 feet bgs. Therefore, additional shallow monitoring probes were installed at six selected locations (MP-31, MP-33, MP-35, MP-44, MP-50 and MP-51) in the predominately clayey and, therefore, more impermeable soils. These probes were generally installed at shallow depths ranging from approximately 7 to 10 feet bgs. These additional shallow monitoring probe locations were added as a means to evaluate the influence of the soil vapor extraction system near ground surface in these areas.

The HMW-series well installations also had two main goals. The primary goal was to bound the horizontal extents of the known LNAPL plume in the Main Sand. A secondary goal was to further evaluate the nature of the LNAPL plume within the Main Sand. Additional goals of the investigation were to establish the presence or absence of separate phase hydrocarbon in the shallower, more permeable strata, overlying the Main Sand. As with the probes (e.g., MP-39A and MP-47C), occasional monitoring well installation may differ from design due to field conditions.

The HSVE-series well installations had one purpose, specifically, to enable the removal of vapors from the unsaturated zone, where residual hydrocarbons are present and from the top of the separate phase hydrocarbon floating on the groundwater. In combination with a soil vapor extraction well (HSVE-1) installed in January 2004 and HSVE-13 to 16, installed in association with the East Watkins Street sewer replacement in April 2004, a total of 14 deep (HSVE-2 to 12 and HSVE-17 to 19), six shallow (HSVE-1S, 6S, 8S, and HSVE-13 through 16) and one intermediate (HSVE-1) extraction wells are present.

In general, the above locations were initially investigated by geoprobes (47 locations) prior to any MP or HMW installation activities. In the cases (seven locations) where conditions precluded the completion of an initial Geoprobe, all borings were completed using a conventional drill rig during MP- or HMW-series installation activities. In addition, as part of the VCS upgrade effort, the borings for the installation of the soil vapor extraction wells (HSVE-series) were completed during this mobilization. In light of the density of data being obtained in the vicinity of the planned replacement extraction wells during the investigation, and to optimize completion of the VCS upgrade, it was decided to install the new HSVE-series wells at this time rather than subsequent to the completion of the MP-series probes as originally presented to the Agencies (Clayton 2004d).

The intent of the geoprobes was to rapidly obtain information to further refine the understanding of the geology and hydrogeology of Hartford, to optimize the screen placement of MPs and HMWs at each planned location, and to validate the interpretation of the CPT/ROST identified LNAL plume. Completion of the Geoprobes also enabled the rapid collection of soil samples for chemical and geotechnical analyses.

The Geoprobe borings were completed using conventional direct push technology by Philip Environmental Services Corporation (PSC) of Columbia, Illinois and their subcontractors. The remaining MP- and HMW-series borings, also completed by PSC

and their subcontractors, were conducted using a conventional drill rig, equipped with hollow-stem augers (HSAs). The multiple MP- and HMW-series Geoprobes, provided sufficient geologic information to confirm the design and screen placement of the new HSVE wells. The HSVE-series borings were also conducted by PSC using a conventional drill rig driving HSAs, though, these borings were blind-drilled.

The Geoprobe and HSA borings were conducted from July 12 through August 30, 2004. All Geoprobe borings were continuously sampled to termination using a 4-foot or a 5-foot sampler equipped with acetate liners. All HSA borings, conducted at locations that had not been previously Geoprobed, were also continuously sampled to termination using split-spoon samplers or a similar continuous split-barrel sampling device advanced before the auger. The remaining HSA borings were generally blind-drilled with the exception of limited split-spoon sampling to ensure proper monitoring probe/well depth placement, which had been designed based on the findings of the Geoprobe borings. Potable water, obtained from a metered fire hydrant located near the Hartford Public Works Department garage, was added to HSA borings only as necessary to facilitate drilling operations/well installation activities. The volume of drilling water not recovered during drilling operations/well installation was estimated and subsequently removed during monitoring well development.

All soil samples were described and classified in a consistent fashion by appropriately trained field personnel knowledgeable of the local geology and hydrogeology. All logging was conducted according to the Unified Soil Classification System. Visual and olfactory observations were noted. Lithologic information recorded included depth, color, soil type and qualitative moisture content. Additional drilling and sampling details were provided in previously submitted Standard Operating Procedures (SOPs) (Clayton 2004a, c). These SOPs may have been modified based on field conditions that would be discussed in the results section. The soil boring logs are provided in Appendix A. For a discussion of the geology and hydrogeology of the investigation area, refer to Section 5.0.

Due to the nature of the Geoprobe, no soil cuttings were generated although the remaining small quantities of soil from the sampler were temporarily stored in an approximately 20-ton roll-off box, located on secured property within Hartford, before offsite disposal by a waste disposal contractor. The Geoprobe boring locations were sealed with bentonite upon completion. Decontamination for all Geoprobe and conventional drilling activities was conducted on secured Hartford property that had been prepared to serve as a laydown and decontamination yard for the planned workscope.

The yard contained an approximately 790 square foot, lined, decontamination pad equipped with a sump, an approximately 6,500-gallon Baker tank, with secondary containment, for temporary liquid storage prior to disposal, and sufficient, approximately 20-ton roll-off boxes, for temporary soil storage prior to disposal. Based on high productivity levels, soil disposal occurred on a frequent, often every third day, basis, and liquid disposal typically occurred on an approximately one-week basis. All liquid and soil had been removed from the site for proper disposal within one-week of completion of field activities.

The completion of the MP-series and the HMW-series installations resulted in the placement of 34 probes/wells in the North Olive, 35 in the Rand, 3 in the EPA, and 56 in the Main Sand Strata. In combination with the existing wells located in Hartford, 34 probes/wells, satisfactory for groundwater data collection, are present in the North Olive Stratum; 38 are in the Rand Stratum, while 4 are present in the EPA Stratum and 76 in the Main Sand. With the installation of the 38 monitoring probe nests and the 15 monitoring well nests (set in various locations and stratums throughout Hartford) a sufficient amount of probes/wells are in place to provide an understanding of seasonal groundwater flow occurrence of separate phase hydrocarbon within Hartford and surrounding areas.

3.1.1 Soil Chemical Analysis Sampling

Soil samples were screened for organic vapors (headspace) upon retrieval using a Photovac photoionization detector (PID) equipped with a 10.6 electron volt (eV) probe at all MP-series and HMW-series locations. The PID, calibrated to an isobutylene standard, measures total concentrations of organic vapors. The PID cannot identify or quantify specific components.

Soil samples were collected for chemical analyses at selected MP-series locations (MP-29, MP-31, MP-34, MP-47, MP-48, MP-53, MP-55, MP-65, MP-66 and MP-67) and at all HMW-series locations (HMW-38 through 52) (Figure 2-1). Soil samples from these locations were generally obtained from the approximate center of all previously named strata (e.g., North Olive and Rand), unless the strata were saturated in which case samples were collected from the unsaturated, if present, portion of the strata. Soil samples were also collected at these locations from the less permeable intervening strata above/below the named strata. The sampling was conducted to provide vertical profile data.

Soil samples recovered from each sampling interval, at borings not chosen for chemical analysis, were typically placed in a sealed plastic Ziploc® bag for geologic classification and headspace analysis with the PID. The bagged samples were allowed to equilibrate for a minimum of 15 minutes with ambient conditions, and a headspace screening was performed using the calibrated PID. The results of the headspace screening from each logged boring are presented on the boring logs and in Table 3-1. Generally, elevated PID readings were observed in areas where petroleum hydrocarbons were detected in soil samples or in proximity to separate phase hydrocarbon.

Soil samples, recovered from intervals selected for chemical analysis, were typically split into two portions. One portion was placed into new, laboratory-supplied containers,

immediately sealed, labeled and then placed in a cooler containing ice for laboratory chemical analysis. The containers were preserved as appropriate. The remaining portion was placed into a new plastic Ziploc® bag for geologic classification and headspace screening as discussed above.

All of the samples, selected for chemical testing, were submitted for analysis of typical petroleum hydrocarbons, specifically, benzene, ethylbenzene, toluene and xylenes (BETX), methyl tert-butyl ether (MTBE) and total lead with a subset consisting of 20 of the 92 total samples analyzed for the Skinner list of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and total inorganics (Clayton and ENSR 2004). The Skinner list encompasses a wider suite of analyses for indicators typically associated with refinery operations. Method 5035 sampling protocol was used for all samples to be analyzed for BETX and/or VOCs. The chemical analyses were conducted by Teklab, Inc. (Teklab) of Collinsville, Illinois, using U.S. EPA SW-846 Methods 5035/8260B for BETX, MTBE and VOCs, SW-846 Methods 3550B and 8270C for SVOCs, SW-846 Methods 3050B, 6010B, 7417A, 9010, and 9014 for metals and lead and SW-846 Methods 3540C and 8270C for PNAs. All soil analytical results were reported on a dry-weight basis with total solids determined using Standard Methods 18th edition 2540G.

3.1.2 Soil Geotechnical Analysis Sampling

Soil samples were collected for geotechnical analyses at the same MP-series and HMW-series locations identified in Section 3.1.1. The sampling was conducted from the same strata as discussed above for the soil chemical analysis sampling though, for physical analysis, saturated conditions were not a concern. The samples were obtained during the Geoprobe borings and the completion of the HSA borings.

All of the samples were submitted for analysis of grain size, moisture, and organic carbon content with selected samples submitted for porosity and/or permeability. Samples, obtained from the chosen interval, were stored in new one-gallon plastic Ziploc® bags, with the exception of samples collected for porosity or permeability analysis which were obtained by advancing a Shelby tube with a drill rig.

3.2 MONITORING PROBE/WELL INSTALLATIONS

A total of 169 monitoring probes/wells were installed (excluding the HSVE wells) at the proposed locations, modified as necessary to accommodate the presence of site features (e.g., utilities), and at various depths based on the identified stratigraphic conditions. The monitoring probes (MP-series) were installed at predetermined locations to monitor the influence of each new soil vapor extraction well and, therefore, the effectiveness of the upgraded Vapor Control System (Clayton 2004d). The monitoring probes were modified to make them more suitable for water / product gauging (Clayton 2004e). The monitoring wells (HMW-series) were also installed at predetermined locations, with several intended to bound the LNAPL plume based on the ROST-derived interpretation of the plume extents (Clayton 2004c). Selected locations within the plume were also chosen for well installation including areas that historically never contained wells.

Monitoring probes were constructed using 1-inch inside-diameter (ID) 0.010-inch factory-slotted polyvinyl chloride (PVC) screen and completed to ground surface with solid 1-inch ID PVC riser. The 1-inch ID probes were only installed in the shallower strata, such as the North Olive and Rand, and were nested in one borehole, unless the intervening clay layer was less than approximately 3 feet in thickness. In that instance, probes were installed in separate borings to eliminate the potential for cross contamination. Monitoring wells and deeper monitoring probes were constructed using 2-inch ID PVC riser and 2-inch ID 0.010-inch factory-slotted PVC screen. The 2-inch ID probes/wells were installed in the EPA Stratum or Main Sand as drilling conditions in

these units typically required the introduction of potable drilling water to enable the installation of the probes/wells at the desired depth. Effective recovery of the introduced drilling water could only be accomplished with 2-inch ID probes/wells. Final screen length at a location, in the case of the EPA, Rand and North Olive Strata, was determined by field conditions. Specifically, the strata thickness and, therefore, varies from approximately 2 to 15 feet. In general, with the Main Sand probes/wells, the screen length was 15 feet where unconfined (water table) conditions were evident, while where confined conditions were apparent, the screen length was 10 feet.

The new HSVE-series extraction wells (HSVE-2 through 12 and HSVE-17 through 19), designed to replace the existing VCB wells (Figure 2-1), were constructed of 4-inch ID PVC well screen and riser pipe. The screens consisted of 20 feet of 0.020-inch factory-slotted openings. The screens, depending upon location, were installed to intersect the alluvial soils overlying the Main Sand or the vadose zone of the Main Sand. Therefore, the well screens were situated to intersect the North Olive and Rand Strata, if/where present and the Main Sand as appropriate. The screened intervals were set from approximately 7 to 27 feet below ground surface (bgs). In general, the new extraction wells penetrated the Main Sand only where this unit was deemed unconfined. Where the Main Sand unit was deemed confined, the extraction wells terminated approximately 2 to 3 feet above this unit to prevent penetration of the well screen into the LNAPL/ groundwater. In addition, three shallow HSVE wells (HSVE-1S, 6S and 8S) were installed at three locations (Figure 2-1). These wells were constructed of the same material as the deeper wells with the only difference being the screen interval placement from approximately seven to twelve feet bgs. These shallow extraction wells will be used to test the ability to remove soil vapors from the shallower, less permeable soils.

The monitoring probe/well installations were completed in accordance with previously submitted SOPs (Clayton 2004a, c) and the Additional Precautions for MPE Pilot Test Well and Probe Installations Memorandum included in Appendix B. The extraction

wells were installed in accordance with these SOPs and the Technical Memorandum, Vapor Control System Upgrade Design (Clayton 2004d). A summary of monitoring probe/well construction details is provided in Table 3-2 including the strata screened by each well. The monitoring probe/well completion reports are found in Appendix C.

Development activities were only conducted on those probes/wells (2-inch ID) that contained groundwater (with the exception of the extraction wells, which do not require development). Prior to development, monitoring probes/wells were allowed to set a minimum of 24 hours after installation. Development was performed (after removal of the estimated volume of water introduced, if any, during drilling) using a variety of equipment including a Grundfos pump, rod pump, or bailers. Development was performed until pH, conductivity, temperature and total dissolved solids stabilized or the wells were pumped dry and allowed to recharge at least three times. In general, the wells recovered rapidly during development. Well development was conducted in general accordance with a previously submitted SOP (Clayton 2004a). Summarized well development indicator parameters are provided in Table 3-3. Generated water and separate phase hydrocarbon, if any, was temporarily stored and managed as discussed in Section 3.1 above.

Each new probe/well, including ground surface elevation, was surveyed by an Illinois-licensed surveyor for horizontal control referenced to Illinois State Plane West Zone NAD 83 (feet) and vertical control referenced to mean sea level (MSL) (feet). The survey was conducted by Crawford, Murphy and Tilly, Inc. (CMT) of Edwardsville, Illinois during August and September 2004.

3.3 LNAPL SAMPLING

On September 8 and 9, 2004, Clayton sampled fourteen probes/wells to obtain samples of the separate phase hydrocarbon for simulated distillation analysis. The simulated

distillation analysis is used to classify possible product types, multiple products, and to discriminate between products of different boiling distributions. The samples were also analyzed for density and kinematic viscosity, which are also indicators of potential product types.

As discussed by Clayton (2004c), the rapid optical screening tool (ROST™) process identified three main hydrocarbon wavelengths, distinguished by color, within Hartford. The wavelengths were considered representative of heavy-range, mid-range, and light-range petroleum hydrocarbons. These are only meant as relative terms. Meaning, that within this area, three distinctive wavelengths (colors) were identified and that, generally speaking, the yellow color is interpreted as being heavier, the blue color lighter, and the green color between the two. These identified wavelengths were generally segregated from the other wavelengths (though there was some commingling) and formed distinct areas (Clayton 2004c). For example, the yellow wavelength was clustered along North Olive Street while the green wavelength was predominant in the northeasternmost portion of Hartford. The remaining majority of Hartford appeared to contain only the blue wavelengths. Wells were chosen to provide samples of separate phase hydrocarbon from each of the areas identified by the ROST™.

The samples were collected from the wells using pre-cleaned, sealed and dedicated PVC bailers. After collection, samples were immediately placed into new laboratory-supplied containers, labeled, placed in laboratory-provided shipping containers, and were delivered, under chain-of-custody procedures to Core Laboratories (Core Lab) of Houston, Texas, for laboratory analysis. The samples were analyzed for the following parameters: simulated distillation using ASTM Method D-2887; kinematic viscosity using ASTM D-445; and density using ASTM D-4052.

The sampling technique resulted in the generation of approximately one pint of water and separate phase hydrocarbon from each well after sample collection. This liquid was handled and disposed as discussed above in Section 3.1.

3.4 MONITORING PROBE/WELL GAUGING ACTIVITIES

Clayton completed a comprehensive well gauging event in Hartford during the week of September 20, 2004. This event was conducted at all of the remaining accessible monitoring wells in Hartford including the sentinel wells (HMW-25 through HMW-29) and all of the newly installed monitoring probes/wells (MP-29 through 67 and HMW-38 through 52). The well gauging, with the cooperation of Premcor, was extended to include the Premcor facility (Premcor wells).

The gauging to evaluate the extent of the LNAPL plume underlying Hartford included gauging at the Premcor facility and historic Shell gauging at the Shell Rand Avenue site and the Shell Tannery Property. Available quarterly reports, prepared by Shell (2002, 2003a, b, c, d, 2004a, b and c) from the third quarter of 2002 to the second quarter of 2004, and by Clayton (2004f) that included the third quarter 2004 gauging of the Shell wells, revealed no separate phase hydrocarbon in any well with one exception. A trace amount of 0.04 feet or less was occasionally identified in one well (SP-30) over the two-year span (3rd Q 2002 to 3rd Q 2004).

As discussed in Section 2.3, the stratigraphy of the northern portion of Hartford consists of four more permeable units separated by intervening clay strata; specifically, the North Olive Stratum, which overlies the Rand Stratum that, in turn, overlies the EPA Stratum. All of these strata overlie the Main Sand. The September 20-22, 2004 event represents the initial comprehensive gauging event of all four units. Prior to the MP- and HMW-series probe/well installations, no existing wells were known to be appropriately screening the North Olive Stratum to enable gauging and the determination of

groundwater (if present) and flow (if any) within this stratum. Similarly, no existing wells were known to be appropriately screening the Rand Stratum to enable gauging and the determination of groundwater flow (if any) within this stratum in Hartford. Historically, the inclusion of the Shell wells provided gauging and groundwater flow data for the Rand and EPA Strata and additional data for the Main Sand beyond the Hartford boundaries. Likewise, the inclusion of the Premcor wells provided additional gauging and groundwater flow data for the Main Sand east of the Hartford boundary.

The well gauging event was conducted to gather a variety of data including identifying the presence or absence of separate phase hydrocarbon, measuring apparent separate phase hydrocarbon thickness in wells (if present), and determining groundwater flow directions. The gauging was conducted using oil/water interface probes. One of the primary intents of the gauging was to "ground-truth" or determine the actual horizontal extent of the identified LNAPL plume within the Main Sand in comparison to the interpreted extent of the LNAPL plume as presented in the ROST report (Clayton 2004c). The gauging was also intended to identify the vertical extent of separate phase hydrocarbon underlying Hartford. The apparent product thickness (where present) measurements were also used to calculate the piezometric surface elevations.

3.5 BAIL-DOWN TESTS

Bail-down tests were conducted to assess separate phase hydrocarbon mobility and qualitatively evaluate the potential for separate phase hydrocarbon recover. The bail-down tests were not intended to evaluate the thickness of separate phase hydrocarbon present in the surrounding formation materials. Bail-down wells (MP-29C, MP-29D, MP-39C, MP-45C, MP-47C, MP-48B, MP-53C, MP-55C, HMW-44C, HMW-46C, HMW-48B, and HMW-48C) (Figure 2-1) were selected to provide a representative distribution across the LNAPL plume. The monitoring probes/wells were screened across permeable zones identified at each location. Bail-down tests were conducted from

September 22 through September 24, 2004. The test consisted of measuring the initial thickness of the separate phase hydrocarbon in the monitoring well with an oil/water interface probe and then attempting to rapidly remove the separate phase hydrocarbon using a disposable plastic bailer. Upon removal of as much separate phase hydrocarbon as practicable, the rate of recovery in the probe/well was measured over time.

The separate phase hydrocarbon and groundwater removed from each well was temporarily stored in a 500-gallon lube cube storage tank in a secure area within Hartford.

3.6 SUMMER 2003 ELM STREET EXCAVATIONS

In Spring of 2003, Praxair Services, Inc. (Praxair) of Burlington, New Jersey, on behalf of Premcor conducted a Tracer Tight Leak Test or tracer gas pipeline integrity test on two pipelines that traverse the northern part of Hartford, beneath Elm Street. The locations of the 70 Praxair monitoring points are shown in Figure 2-1.

The tested lines consisted of a ten-inch ID diesel line and a ten-inch ID gasoline line. The gasoline and diesel pipelines share the corridor under Elm Street with a 14-inch ID black oil line that was not tested, as it is no longer in use. Tracer gases were detected at two locations along the lines east of North Olive Street.

Subsequently, at the end of July 2003, Premcor excavated and examined the pipelines in the area east of North Olive Street. The pipelines were also inspected by a smart pig while the lines were shut down. A smart pig is an inspection vehicle that can identify features, such as corrosion or other anomalies in the pipe. The pig is typically pushed along through the pipe by the product transported within the line though it may also be self-propelling. The smart pig identified anomalies, specifically, thinning of the pipe walls.

Premcor, from August to November 2003, excavated and examined the pipelines in the areas of the anomalies. Premcor, based on the visual examinations, replaced several sections of the pipelines along Elm Street. The replacement activities spanned the entirety of Elm Street from the intersection with Old St. Louis Road to approximately 70 feet east of North Olive Street. The replacement activities, conducted by Midwestern Contractors of West Chicago, Illinois, resulted in the excavation of eight separate trenches. Figure 3-1 shows a plan view of the eight trenches along Elm Street that were excavated sequentially as trenches A through H. The excavations were backfilled with clean soil material upon completion of the replacement process. The excavated soil was placed in roll-off boxes and removed for disposal at a permitted disposal facility.

Clayton observed the excavation process. The three pipelines are approximately 12 feet bgs east of North Olive Street and approximately five to six deep along Elm Street. The base of the excavation east of North Olive Street was approximately 14 feet bgs while it was approximately 8 feet bgs along the majority of Elm Street. Concurrent with the repair activities, Clayton collected soil samples from the sidewalls and base of the eight excavations, to provide analytical data regarding existing conditions. In one of the trenches, specifically east of North Olive Street, additional soil removal was conducted after initial sampling. Clayton subsequently collected soil samples from the expanded excavation sidewalls and base.

Sampling for chemical analysis was conducted in a similar manner as described in Section 3.1.1. All of the samples, selected for chemical testing, were submitted for analysis of typical petroleum hydrocarbon indicators, specifically, BETX and polynuclear aromatic compounds (PNAs). The sample locations are shown in Figures 3-2 through 3-5. The analytical results are discussed in Section 4.0.

A subsequent tracer gas test was performed by Praxair in April through May of 2004. The tracer gas was not detected at the Praxair monitoring points.

3.7 APRIL 2004 EAST WATKINS STREET SEWER REPLACEMENT

GL Warren, on behalf of the Village of Hartford, completed sanitary sewer replacement activities along East Watkins Street in April 2004 (Figure 2-1). Clayton, on behalf of the HWG, was on-site to observe excavation activities associated with the replacement. ENSR Corporation (ENSR) also observed the sewer replacement on behalf of the HWG (ENSR 2004a). The sewer replacement work extended east from the intersection with North Market Street to approximately 250 feet west of the intersection with North Olive Street. The new sewer consisted of a 24-inch ID PVC SDR-35 pipe bedded in gravel and backfilled with sand to approximately 2.5 feet bgs.

The sewer main, located in the middle of East Watkins Street, sloped down from east to west with the low point at the intersection of East Watkins and North Market Streets. The existing sewer main was a 24-inch ID concrete pipe. Soils removed from around the main and the laterals were observed to be cohesive silts or clays. No permeable sand or gravel backfill was observed. It appears that the original sewer was backfilled with existing native clays and silts. It is unknown whether this backfill material is representative of backfill around other utilities in Hartford.

The observed condition of the old sewer was considered poor as the main had multiple holes and cracks. Sediment had accumulated on the bottom of the sewer interior. The sediment thickness generally increased from west to east, with the thickest deposits of approximately 6 to 8 inches being at the east end of the main. This sediment was a tightly packed, black, sand, gravel and clay mixture.

Clayton screened soil samples, using a calibrated PID from multiple locations along the sewer trench along with sediment samples from inside the pipe. The apparent most petroleum-impacted areas encountered were sediments inside the old sewer pipe, which had a strong petroleum-like odor and elevated PID readings at several locations. PID

screening results also revealed concentrations of organic vapors in the soils below the main at several locations along the sewer trench. Petroleum-like odors were also noted at these locations. Apparent petroleum impacts were more prevalent on the eastern portion of the sewer, that is proximate, though south of, the North Olive Street pipeline corridor. The apparent petroleum impacts were generally observed to diminish from east to west along the sewer main. The PID readings have been summarized in Table 3-4.

Clayton also observed the existing water laterals exposed during the excavation. These lines consisted of approximately 1-inch ID copper or corrugated steel pipe. These lines were buried approximately 2.5 to 3.5 feet bgs. Most locations, including all older corrugated steel lines, also appear to have been backfilled with existing native soils. Some of the copper pipe locations were backfilled with sand. Petroleum-like odors were not noted in any of the water line backfill materials.

During sewer replacement activities, in cooperation with the Village of Hartford, Clayton completed installation of four shallow SVE wells (HSVE-13 through HSVE-16) (Figure 2-1) within the new permeable sewer backfill. These wells were installed for future use as part of a shallow vapor control system (VCS) of the East Watkins Street sewer. These wells consisted of 4-inch ID schedule 40 PVC vertical wells set approximately 6 inches below the bottom of the new sewer pipe within the gravel sewer bedding. Screens were 0.020-inch factory-slotted and five feet in length. Solid 4-inch ID PVC riser extended from the top of the well screen to the surface. The extraction wells were finished with a steel flush-mount cover. Figure 3-6 presents a schematic of the SVE well installations.

In addition, Clayton installed eight vapor-monitoring points (MP-17 through MP-24) (Figure 2-1) in the replacement sewer backfill to facilitate future soil gas sampling for evaluation of petroleum vapor migration. The vapor monitoring points were set in the sewer trench backfill, immediately above the sewer pipe. The screens were set above the sewer pipe to minimize the possibility of the screen being submerged due to water

accumulation at the base of the sewer trench. The vapor monitoring points were constructed using a 6-inch long stainless steel soil vapor screen connected to 1/8-inch ID stainless steel tubing. A ½-inch ID section of solid PVC was placed around the 1/8-inch ID steel tubing to protect it. The points were finished in a steel flush-mount cover or within larger SVE vault boxes. The trench was backfilled with sand to approximately 2.5 feet bgs and larger stone to just below ground surface to create a base for the asphalt paving. A design schematic of the vapor monitoring points is shown in Figure 3-7.

4.0 RESULTS OF LNAPL SUBSURFACE INVESTIGATION

The results of the LNAPL subsurface investigation are provided in the following section. Included are soil chemical and geotechnical analysis results, monitoring probe / well gauging results, separate phase hydrocarbon analysis results, and separate phase hydrocarbon bail down test results.

4.1 RESULTS OF SOIL BORING/GEOPROBE®/EXCAVATION SAMPLING

Clayton conducted soil sampling for chemical and geotechnical analysis at ten monitoring probe locations (MP-29, MP-31, MP-34, MP-47, MP-48, MP-53, MP-55, MP-65, MP-66, and MP-67), at all 15 of the monitoring well locations (HMW-38 through 52) and at 1 well (HMW-35) installed as part of an MPE Pilot Test (Clayton 2004g). ENSR obtained soil samples from eight locations (PMP-18, VMP-12, VMP-15, VMP-21, VMP-22, VMP-24, VMP-36, and VMP-44). Overall, 197 soil samples were collected for chemical analysis and 117 soil samples were collected for geotechnical analysis.

Electronic copies of the chemical laboratory analytical reports were transmitted to the U.S. EPA and the Illinois EPA as they were received from the laboratory. Paper copies of the laboratory analytical reports are maintained at Clayton's office in Downers Grove, Illinois and ENSR's office in Warrenville, Illinois.

4.1.1 Soil Chemical Analysis Results

The soil chemical analytical results are summarized in Table 4-1. An evaluation of the Quality Assurance/Quality Control (QA/QC) samples from the 2004 Clayton sampling did not reveal any concerns, with one exception. One set of samples, collected on August 23 and 24, 2004, was identified as being received outside of applicable temperature compliance on the laboratory's sample receipt checklist. The Clayton field crew confirmed that the out-of-compliance samples had been double-bagged (Ziploc®),

placed on ice in a cooler immediately upon collection, and delivered to the laboratory on ice. A review of procedures indicated that the double bagging of the samples likely trapped air between and within the bags, which is believed to have acted as an insulator. In the future, sample storage procedures will include minimizing, to the extent practical, the volume of trapped air before storage in the iced cooler.

For discussion purposes, based on the quantity of data, the analytical results from the North Olive Stratum and other strata will be presented only as total detected BETX or SVOC/PNA concentrations with the BETX data presented first. No samples were collected from the EPA Stratum as it was saturated at all encounters.

A total of 28 samples were analyzed from the North Olive Stratum across northern Hartford (Figures 3-2 and 4-1). The BETX concentrations ranged from 10^1 to 10^5 micrograms per kilogram (µg/kg). The 12 samples collected from the base of excavation A (Figure 3-2) were considered, based on field observation to be from the native N. Olive Stratum and are presented together with the 2004 data. Twenty-one of the samples were obtained from areas overlying the LNAPL plume while the remaining seven were collected from areas immediately surrounding the LNAPL plume. A review of the results from within and exterior to the LNAPL plume does not indicate a significant correlation to the plume. Of the ten lower BETX concentrations, less than approximately 50 µg/kg, five are samples from outside the LNAPL plume with the remaining five samples from within the plume. However, the BETX results do indicate a correlation to the known petroleum pipeline corridors, identified in Section 2.2, with some exceptions. Specifically, ten of the eleven samples (including duplicates) with the highest BETX concentrations, ranging 10^4 to 10^5 µg/kg, are present in borings/ excavations that are within the North Olive Street or the Elm Street corridor. The one boring (HMW-43) sample with a comparable BETX concentration, 10^5 µg/kg, was collected from a location proximate, though south of the known North Olive Street corridor.

A total of ten samples were analyzed for BETX from the Rand Stratum from various locations overlying the LNAPL plume (Figure 4-2). A review indicates three samples (VMP-12, VMP-15 and VMP-22) may have been collected from saturated conditions; therefore, these samples were not included in the following discussion. The BETX concentrations ranged from 10^1 to 10^6 µg/kg. A review of the results again indicates a correlation to the pipeline corridors. The two lowest BETX levels, in the 10^1 µg/kg range, were distant relative to the pipeline corridors, while the remaining five BETX concentrations, ranging from 10^5 to 10^6 µg/kg were in the vicinity of one or more pipeline corridors, specifically, the Elm Street, the North Olive Street and the Rand Avenue corridors. Again, the BETX distribution in the Rand Stratum correlates well with pipeline sources.

Seventeen samples (including duplicates) were analyzed from the Main Sand (Figure 4-3). A review indicates three samples (VMP-21, VMP-36 and VMP-44) may have been collected from saturated conditions; therefore, these samples were not included in the following discussion. The BETX levels ranged from 10^0 to 10^5 µg/kg. At two locations, due to the thinning of the alluvial silt and clay above the Main Sand, samples were obtained at two different depths. Of the 14 samples, 12 were collected from outside the LNAPL plume. The BETX concentrations of these samples ranged from 10^0 to 10^1 µg/kg. A review of the results supports the identification of the LNAPL plume extent within the Main Sand as presented in Section 6.0. The samples (including a duplicate) from within the plume had a BETX concentration of 10^5 µg/kg. The limited vertical profile near East Hawthorne Street, did not indicate any notable trend with depth at these two locations.

There were no detected concentrations of MTBE within the North Olive, Rand or Main Sand Strata. The total lead results did not indicate a correlation to the detected BETX in these strata, though the lead results do appear to be generally lower outside of the plume and the pipeline corridors. The 2003 sampling did not include MTBE and lead.

A total of 58 samples (including duplicates) were taken from the clay strata in 2004. Although it is unknown whether the 67 clay strata samples collected from the 2003 Elm Street excavations were from native, undisturbed clay or from clay fill, due to the long term existence of pipelines along Elm Street, the samples were considered more likely to be clay fill. Therefore, the results of these samples are discussed separately from the results obtained from the boring locations.

Based on the complexity of the stratigraphy, the following discussion is limited to selected clay strata, for example, the clay strata overlying and underlying the North Olive and Rand Strata (where present). Also, due to the complexity of the stratigraphy, sample results may be applied to more than one clay stratum, for example, the North Olive and Rand Strata merge at monitoring well HMW-39. Therefore, the HMW-39 results from the clay stratum overlying the merged North Olive and Rand units are incorporated in the separate discussions regarding the clay stratum overlying the North Olive and Rand Strata, respectively.

Twenty-one samples were identified as being obtained from the clay overlying the North Olive Stratum (Figure 4-4). The clay above the North Olive Stratum contained BETX concentrations ranging from 10^{-1} to 10^{5} µg/kg. The three highest BETX concentrations, at 10^{5} µg/kg, were present in or proximate to the North Olive Street and Rand Avenue pipeline corridors. The next three highest BETX concentrations ranged from 10^{2} to 10^{3} µg/kg, with two of the three in a pipeline corridor, specifically, the Rand Avenue corridor. The remaining 15 samples contained BETX below 10^{2}µg/kg. No apparent correlation was observed between the BETX concentrations and the LNAPL plume in this clay stratum.

Fifteen samples (including duplicates) were identified as being collected from the clay below the North Olive Stratum (Figure 4-5). As with the clay above the North Olive Stratum, there was a wide variation in BETX concentrations, ranging from 10^{-1} to

10^5 µg/kg. In general, the higher concentrations of BETX were again in or near pipeline corridors with the lower total BETX concentrations more distant from pipeline corridors. All six concentrations with a magnitude of 10^4 or 10^5 µg/kg were in, or proximate, to one or more of the three pipeline corridors while four of the eight BETX concentrations less than or equal to 10^3 µg/kg were considered distant from pipeline corridors. Again, no apparent correlation was observed between the LNAPL plume and the BETX concentrations in this stratum.

Eleven samples were considered as being collected from the clay overlying the Rand Stratum (Figure 4-6). Again, there may be duplication with the other discussions of results. The BETX levels ranged from 10^{-1} to 10^5 µg/kg. As before, the higher concentrations of BETX in the clay above the Rand Stratum were also in or near pipeline corridors with the lower BETX concentrations more distant from pipeline corridors. The three concentrations with a magnitude of 10^4 or 10^5 µg/kg were in, or proximate, to one or more of the three corridors while six of the eight BETX concentrations less than or equal to 10^3 µg/kg were considered distant from pipeline corridors. No significant correlation between the LNAPL plume and the BETX concentrations was noted.

Ten samples were identified as being collected from the clay below the Rand Stratum (Figure 4-7). There was again a wide variation in BETX concentrations, ranging from 10^0 to 10^5 µg/kg. Six of the samples were collected in or proximate to the North Olive Street and Elm Street pipeline corridors. The BETX concentrations in these pipeline corridors ranged from 10^3 to 10^5 µg/kg while the four outside the corridors ranged from 10^0 to 10^4 µg/kg with only one sample at 10^4 µg/kg. In general, the higher BETX concentrations were observed within the LNAPL plume.

Five samples were identified as being obtained from the clay above the EPA Stratum (Figure 4-8). Only two samples had BETX concentrations equal to 10^3 µg/kg and both are within the North Olive Street and or Rand Avenue pipeline corridor (though a

duplicate had no BETX concentrations above reporting limits). The remaining two samples ranged from 10^{-1} to10^{0} µg/kg, and are more distant from the three pipeline corridors. Again, the higher BETX concentrations were generally observed in the LNAPL plume.

Three samples were identified as being collected from the intervening clay below the EPA Stratum (Figure 4-9). The range in BETX concentrations varies from 10^{1} to 10^{3} µg/kg. The two highest BETX concentrations, ranging from 10^{2} to 10^{3} µg/kg were collected from the North Olive Street and/or Rand Avenue pipeline corridors. The lowest BETX concentration was observed beyond the LNAPL plume.

Twenty-three samples were identified as obtained from the clay above the Main Sand. The BETX levels ranged from 10^{0} to 10^{5} µg/kg (Figure 4-10). Ten of the 12 highest BETX concentrations, which ranged from 10^{3} to 10^{5} µg/kg, were again generally obtained from or proximate to the three pipeline corridors. The BETX concentrations for the more distant locations ranged from 10^{0} to 10^{4} µg/kg; however, only two of the 12 samples were equal to or above 10^{3} µg/kg. Generally, the lowest BETX levels were observed outside the LNAPL plume.

In light of the apparent correlation between the highest BETX concentrations and the petroleum pipeline corridors, the BETX analysis data for the boring locations was compiled in a vertical profile (Figure 4-11). In general, at those locations distant from a pipeline corridor, the BETX concentrations increase with increasing depth while at those proximate or in a pipeline corridor, the BETX concentrations stay consistent or decrease with depth. For example, HMW-48, which is associated with both the Rand Avenue and the North Olive Street pipeline corridor, revealed the highest BETX concentration of 10^{5} µg/kg at the shallowest depth of 6 to 8 feet bgs decreasing to 10^{2} µg/kg at 42 to 44 feet bgs. A similar observation can be made at other boring locations within pipeline corridors, such as HMW-43 and HMW-44, taking into consideration the approximate

depth of the pipelines. In contrast, at locations distant from pipeline corridors, it generally would be expected that BETX concentrations would increase with increasing depth as one nears the LNAPL plume. For example, BETX concentrations increase with increasing depth at boring location MP-34, with a BETX concentration of 10^0 µg/kg at 13.5 feet bgs increasing to 10^4 µg/kg at 27.5 feet bgs.

No MBTE concentrations were detected above the applicable reporting limit in any of the 58 clay strata samples though estimated MBTE concentrations were identified in two samples, ranging from 74 to 640 µg/kg. The absence of MTBE above applicable reporting limits from the soil sampling conducted during this investigation indicates that MTBE is not a constituent of concern. Overall, the total lead results did not indicate a correlation to the LNAPL plume, the detected BETX or the pipeline corridors in the clay strata. The vertical profile (Figure 4-11) supports the lack of a correlation between the LNAPL plume, the detected BETX, the pipeline corridors and the detected lead.

A total of 20 samples were analyzed for the Skinner List of SVOCs. Only nine of the North Olive Street and/or Rand Avenue samples contained concentrations of SVOCs above reporting limits. No concentrations of SVOCs were detected in the five samples (four obtained from within the plume and a pipeline corridor) obtained from the North Olive Stratum. SVOCs were detected in the four samples from the Rand Stratum, which were also within the plume and a pipeline corridor, specifically, the North Olive corridor and/or Rand Avenue corridor. The SVOCs in the Rand Stratum ranged from 10^3 to 10^4 µg/kg. The remaining five samples with detectable levels of SVOCs were in the intervening clay strata. The SVOC concentrations in these clay samples ranged from 10^2 to 10^4 µg/kg with four of these samples obtained from the North Olive Street and/or Rand Avenue pipeline corridors.

A total of 20 samples were collected and analyzed for the Skinner List of total inorganics with 17 of the samples from within the LNAPL plume. No significant differences were

observed between the detected levels of total inorganics within and outside the LNAPL plume or in relation to the pipeline corridors.

A total of 67 samples were obtained in 2003 from the near surface clay/fill strata overlying the North Olive and Rand Strata (where present) or the Main Sand during the Elm Street activities (Figures 3-2 through 3-5). Overall, the BETX concentrations from all of the excavation samples ranged from 10^0 to 10^5 µg/kg within the Elm Street pipeline corridor. Three of the excavations (Excavations D, E and G) had BETX levels ranging from 10^1 to 10^2 µg/kg. Two excavations (Excavations C and H) had BETX levels ranging from 10^0 to 10^3 µg/kg. The BETX concentrations from the remaining excavations (Excavations A, B and F) ranged from 10^0 to 10^5 µg/kg with Excavation F containing all four of the 10^5 µg/kg concentrations. The 67 samples were also analyzed for PNAs during the 2003 Elm Street activities. The PNA concentrations from this material in all eight of the excavations ranged from 10^1 to 10^2 µg/kg.

4.1.2 Soil Geotechnical Analysis Results

The soil geotechnical results are summarized by strata in Table 4-2. A total of 21 samples were taken from the North Olive Stratum with 18 of the total described as silt. The remaining three were described as clay. The average grain size composition of the North Olive Stratum was 67% silt, 22% clay and 11% sand. The silt composition ranged from 25 to 83%; the clay composition ranged from 10 to 66% and the sand ranged from 2 to 64%. The average porosity value in the North Olive Stratum at the Hartford Community Center (HCC), in the northwest portion of Hartford, was 49%, while the organic carbon content averaged 0.032 milligrams per kilogram (mg/kg). The porosity values ranged from 48 to 51%. The average hydraulic conductivity of the North Olive Stratum, at the HCC, was 1 x 10^{-4} centimeter/second (cm/s) with the geomean being 1.9 x 10^{-5} cm/s.

A total of 15 samples were taken from the Rand Stratum with twelve identified as silt and three described as clay. The average grain size composition of the Rand Stratum consisted of 61% silt, 26% clay and 13% sand. The silt composition ranged from 15 to 78%; the clay composition ranged from 11 to 85% and the sand ranged from 0 to 38%. The average organic carbon content was 0.030 mg/kg. The porosity at the HCC averaged 54%.

Three samples were taken from the EPA Stratum. Two of the three samples were described as sand with the remaining sample described as silt. The average grain size composition of the EPA Stratum samples consisted of 68% sand, 22% silt and 10% clay. The sand composition ranged from 36 to 96%; the silt composition ranged from 1 to 51% and the clay ranged from 3 to 14%. The organic carbon content averaged 0.055 mg/kg, while one sample had a porosity of 42%.

A total of 22 samples were taken from the Main Sand with fifteen identified as sand. Six of the remaining seven samples were described as silt with one identified as clay. The average grain size composition of the Main Sand was 64% sand, 28% silt and 8% clay. Several samples contained trace amounts of gravel. The sand composition ranged from 3 to 96%; the silt composition ranged from 1 to 79% and the clay ranged from 2 to 40%. The organic carbon content averaged 0.024 mg/kg, while the average porosity was 44%.

A total of 56 samples were taken from the less permeable strata overlying the North Olive and intervening between the Rand and EPA Strata. The deposits were identified predominantly as clay. The average grain-size composition of these strata was 49% clay; 45% silt and 6% sand, while the organic carbon content averaged 0.044 mg/kg. Three samples had an average porosity of 52%.

4.2 MONITORING PROBES/WELLS LNAPL GAUGING RESULTS

Groundwater and separate phase hydrocarbon (if any) gauging data from September 2004, along with prior 2004 data, are summarized in tables contained in Appendix F. Appendix F also contains tables providing the results of the most recent gauging for the Shell wells and the wells on the Premcor facility, respectively. The separate phase hydrocarbon apparent thickness data has been plotted on figures of the identified hydrostratigraphic units to provide both a horizontal and vertical distribution of separate phase hydrocarbon, if identified in a unit. The gauging results identified the presence of separate phase hydrocarbon predominantly within the Main Sand, however, small, localized areas of separate phase hydrocarbon were also found within both the EPA and Rand Strata. No separate phase hydrocarbon was identified within the North Olive Stratum. Further discussion on the presence and extent of separate phase hydrocarbon is presented in Section 6.0.

4.3 LNAPL ANALYSIS RESULTS

In general, properties of refined products vary due to a number of factors including the petroleum source and the refining process itself. Therefore, the following results can only be discussed in a representative manner and should not be construed as indicative of a particular source of the identified LNAPL plume.

The simulated distillation analytical results provided a boiling range distribution for each sample. A graph containing reference standard distillation ranges for a variety of products is presented after the Graphs tab. This graph presents the percentage boiled off versus temperature (°F) for several standard references ranging from crude (38 API Crude) to refined products (gasoline). The results for each individual separate phase hydrocarbon sample were overlain on a graph that presents these reference standards. These graphs are

also presented after the Graphs tab. The laboratory analytical report is contained in Appendix D.

As can be seen from the plots, the results generally fall within a range between gasoline and diesel fuel. Overall, seven of the sampled locations appear to more closely resemble gasoline (MP-32B, MP-35D, MP-37D, MP-39C, MP-45C, MP-49C, and MP-52C) while two of the separate phase hydrocarbon samples appear to plot in a range more closely resembling diesel (MP-29C, HMW-48C). Five of the sampled locations (HMW-44C, HMW-46C, MP-29D, MP-47C and MP-55C) appear to contain similarities to both the gasoline and diesel references. The separate phase hydrocarbon sample locations are presented in Figure 2-1.

The kinematic viscosity is the absolute viscosity of a fluid divided by its density at the same temperature of measurement. It is the measure of a fluid's resistance to flow under gravity, as determined by test method ASTM D 445. Viscosity is temperature dependent; therefore, for kinematic viscosity to be meaningful a reference temperature must be identified. The kinematic viscosity of eleven of the sampled locations ranged between 0.50 to 0.77 CentiStokes (cSt) @ 40° C (HMW-44C, MP-29D, MP-32B, MP-35D, MP-37D, MP-39C, MP-45C, MP-47C, MP-49C, MP-52C and MP-55C). One sample (HMW-46C) had a kinematic viscosity of 1.08 cSt @ 40° C while the remaining two samples (MP-29C and HMW-48C) had kinematic viscosities ranging from 2.00 to 2.16 cSt @ 40° C. Literature values for the kinematic viscosities of gasolines and diesel fuels has identified ranges from 0.40 to 0.71 cSt @ 37.8° C for gasolines and 2 to 6 cSt @ 37.8° C for a diesel fuel. (http://www.engineeringtoolbox.com/21_397 2004).

The density of a substance, which is also temperature dependent, equals its total mass divided by its total volume. The density of eleven of the sampled locations ranged between 0.7324 to 0.7804 g ml @ 60° F (MP-29D, MP-32B, MP-35D, MP-37D, MP-39C, MP-45C, MP-47C, MP-49C, MP-52C, MP-55C, and HMW-44C), while the remaining

three samples ranged from 0.8032 to 0.8480 g/ml @ 60° F (MP-29C, HMW-46C and HMW-48C). Literature values for density range from 0.72 to 0.76 g/ml @ 15.6° C (60° F) for automotive gasoline and 0.87 to 0.95 g/ml @ 20° C (68° F) for #2 fuel oil (Newell et al. 1995). Other density values are 0.729 g/ml @ 59° F for automotive gasoline and 0.827 g/ml @ 59° F for automotive diesel fuel (API, 1996).

Overall, the kinematic viscosity and density results regarding the nature of the product are consistent with the simulated distillation results. Furthermore, these analysis results are in relative agreement with the findings of the ROST™ report (Clayton 2004c). The simulated distillation results do indicate that the ROST findings are relative in nature rather than absolute. The ROST borings indicated there were three main petroleum hydrocarbon wavelengths, distinguished by color, present within Hartford. The yellow/orange wavelength was considered representative of the presence of a heavy-range hydrocarbon. The green-green/yellow wavelength was considered representative of a mid-range hydrocarbon, while the blue wavelength was considered indicative of a lighter-range hydrocarbon. Commingling of the identified petroleum hydrocarbon, which occurred in several areas of Hartford, was represented by the simultaneous presence of two or more of the individual hydrocarbon wavelength colors on the ROST graph.

The ROST findings indicated that the majority of the identified LNAPL plume throughout Hartford consisted of lighter-range petroleum hydrocarbons. This is supported by the simulated distillation, density and kinematic viscosity analysis results that indicate the presence of gasoline-range separate phase hydrocarbon, which is considered a lighter-range product, throughout the same general area as the lighter-range petroleum hydrocarbon ROST results. The separate phase hydrocarbon analytical results indicating the presence of diesel-range hydrocarbon, which is considered a mid-range product, similarly support the ROST identification of a mid-range petroleum hydrocarbon adjacent to Rand Avenue in the northernmost portion of Hartford.

However, the results require a reevaluation, for the purposes of this report, as to the nature of the indicated heavy-range ROST petroleum hydrocarbon wavelength that was identified along the North Olive Street corridor between East Cherry Street (to the north) and East Watkins Street (to the south). The simulated distillation, viscosity and density results generally contained similarities to both gasoline and diesel along this portion of the North Olive Street corridor rather than a heavy-range LNAPL (e.g. lube or fuel oil) as indicated by the ROST. However, the ROST did clearly differentiate the LNAPL plume within this portion of the North Olive Street corridor from the majority of the gasoline-range LNAPL plume underlying Hartford. The simulated distillation results for this portion of the North Olive Street corridor also appear different from the samples more aligned to the gasoline referenced.

The seven apparent gasoline range samples were all found in the Main Sand, as were the five apparent gasoline/diesel-range mixture samples. The two apparent diesel range samples were found in the Rand and EPA stratum in the northeastern most portion of Hartford.

Overall, the findings of the simulated distillation and other analyses support Clayton's opinion that the design of the remediation system will be primarily based upon the geology of the area and the amount of product present, not the type of product present (Clayton 2004e). Furthermore, these results support prior observations that indicated the LNAPL plume was refined product and not crude oil.

4.4 BAIL-DOWN TEST RESULTS

From September 22 through September 24, 2004, Clayton conducted separate phase hydrocarbon bail-down tests at twelve monitoring wells. The tests were conducted at monitoring wells HMW-44C, HMW-46C, HMW-48B, HMW-48C, MP-29C, MP-29D, MP-39C, MP-45C, MP-47C, MP-48B, MP-53C, and MP-55C (Figure 2-1).

Initial apparent separate phase hydrocarbon thickness in the wells ranged from 0.05 feet in HMW-48B to 4.11 feet in HMW-48C. Upon completion of separate phase hydrocarbon removal, the thickness and its recovery rate were monitored for a period ranging from 10 minutes to 2,843 minutes. Because of their rapid recovery rate, bail-down tests were performed twice on wells MP-29D and HMW-44C. Due to the limited presence of separate phase hydrocarbon in HMW-46C (0.20 feet in thickness), HMW-48B (0.05 feet in thickness), and in MP-29C (0.48 feet in thickness) qualitative analyses of the bail-down tests were not performed for these wells. Additionally, due to inconclusive data results, a qualitative analysis of the bail down test for MP-48B was not performed. Bail-down data forms are provided in Appendix E. This data was used to graph the results of the recovery test at eight locations (HMW-44C, HMW-48C, MP-29D, MP-39C, MP-45C, MP-47C, MP-53C, and MP-55C).

Six of the wells (HMW-46C, HMW-48C, MP-29C, MP-39C, MP-45C, and MP-53C) recovered less than 40 percent (%) of their initial apparent thickness during the measured recovery period. The bail down test conducted for MP-45C was stopped at 145 minutes due to time constraints and may not have been allowed ample time to recover. One well (MP-48B) appears to have recovered to approximately 55 % in the first 10 minutes, then spiked approximately 10 % before declining to approximately 40 % for the duration of the recovery monitoring, however, the accuracy of this data is inconclusive. The recovery at one well (MP-47C) generally stabilized at approximately 40 % of initial apparent thickness after approximately 55 minutes, then spiked to approximately 147 % during the next 27 minutes, remaining at that level over the next 40 minutes. The recovery observations during this test are not readily explainable based on available data; however, they may be influenced by factors such as heterogeneity of the formation.

Three of the twelve wells (HMW-44C, MP-29D and MP-55C) recovered approximately 100 % of their initial apparent thickness. Well MP-55C recovered less than 60 % during the first hour and recovered to 98 % after 1,125 minutes. The initial test conducted on

MP-29D resulted in a gradual recovery of 100 % within 78 minutes and then a gradual decline to approximately 84 % over the next 965 minutes. The second test conducted on MP-29D resulted in a gradual recovery of 100 % within 29 minutes. The two tests conducted on HMW-44C indicated an 80 % recovery within the first minute and a gradual recovery to 100 % within approximately 5 minutes for the first test and 14 minutes for the second test.

Temporal variability may influence bail-down test results. Therefore, additional bail-down tests need to be conducted to evaluate the effects of groundwater fluctuations.

5.0 CURRENT PHYSICAL SETTING INTERPRETATION

The geology and hydrogeology of the northern portion of Hartford, introduced in Section 2.0, is discussed in more detail below. The discussion is based on interpretations of the findings of this LNAPL plume investigation, supplemented by the CPT/ROST investigation and the December 2003 sentinel well installations (HMW-25 through HMW-29) (Clayton 2004c), which, together, have provided a comprehensive evaluation of the northern portion of Hartford. In addition, information provided by ENSR (2004b) has been incorporated. The extents of the various strata and the stratigraphy of the area under investigation, described below, are illustrated by maps and geologic cross-sections. The named strata extent maps (with the exception of the areally extensive Main Sand) are presented as Figures 5-1 through 5-3 while the cross-sections are designated as illustrated in Figure 5-4. The cross-sections are presented in Figures 5-5 through 5-8.

5.1 GEOLOGY/HYDROGEOLOGY

An alluvial veneer of silts and clays, overlying the areally extensive Main Sand, is present throughout the northern portion of Hartford. The LNAPL plume investigation borings provided further refinement of both the horizontal and vertical extents of the four identified hydrostratigraphic units. However, the investigation did not reveal any significant differences in either hydrostratigraphy or lithology from that determined in the CPT/ROST investigation (Clayton 2004c).

The alluvial silts and clays generally thicken in an easterly direction from Old St. Louis Road towards North Olive Street. A similar thickening occurs in a northerly direction from Hawthorne Avenue to Rand Avenue. Three, more permeable units are observed in the alluvial deposits. In descending order, from ground surface, are the North Olive, Rand and EPA Strata which all overlie the Main Sand. The Main Sand extends to bedrock at an estimated depth of approximately 150 feet bgs in the Hartford area. The

North Olive and Rand Strata are primarily identified as silt with the EPA Stratum consisting of sand and silt. The four strata have generally combined into one hydrostratigraphic unit, the Main Sand, south of Watkins Street. As discussed below, the exact extent and continuity of relatively thin units (such as the EPA, Rand, and North Olive Strata) remain somewhat uncertain because of geologic heterogeneities related to the depositional environment of the area.

This investigation and earlier work by Clayton (2004c) revealed the upper portion of the Main Sand consists primarily of fine-grained sand with varying amounts of silt and trace amounts of clay. The Main Sand also contains discontinuous silty clay and clayey silt lenses, ranging up to approximately 10- to 15-feet-thick, generally south of Forest Street and extending south beyond the investigation area. The structural surface map reveals that the Main Sand hydrostratigraphic unit is present as shallow as approximately 9 feet bgs in the south end of the north half of Hartford, near Watkins and Forest Streets (Figure 5-9). The surface of the Main Sand unit trends down in a northerly direction, towards Rand Avenue, where it is as deep as approximately 45 feet bgs in the northeast section of Hartford. Average depth to Main Sand is 25 feet bgs. The top of the Main Sand can be encountered as shallow as 422 feet MSL to as deep as 385 feet MSL. As indicated by both historical and September 2004 mapping, the groundwater within the Main Sand flows in a general northerly direction. It appears to become confined in the northern end of Hartford.

The EPA Stratum is separated from the Main Sand by a relatively thin silty clay layer in the investigation area. As previously presented by Clayton (2004c), the EPA Stratum pinches out to the south of a southeasterly trending line drawn from the Old St. Louis Road and North Delmar Avenue intersection to just north of the East Date Street and North Olive Street intersection (Figure 5-3). South of this boundary, the EPA Stratum and Main Sand form one hydrostratigraphic unit. Observations and analysis of the EPA, which appears to be similar to the Main Sand, indicate the stratum is composed primarily

of sand with lesser amounts of silt and trace clay. The surface of the EPA Stratum ranges from approximately 30 to 34 feet bgs (average elevation of 399 feet MSL) underlying Hartford (Figure 5-10). The isopach reveals that the EPA Stratum ranges from approximately 5 to 8 feet thick within and north of Hartford (Figure 5-11). As indicated by the September 2004 mapping, the groundwater within the EPA Stratum flows into the Main Sand south of the merge of the EPA and Main Sand strata. The groundwater appears to become confined within the EPA Stratum to the northeast of Hartford.

The Rand Stratum appears to extend across the majority of the northern portion of Hartford from approximately Rand Avenue to the north to Date Street to the south (Figure 5-2). The Rand Stratum extends east of North Olive Street and west past Old St. Louis Road. To the south of Date Street, in a similar fashion as the EPA Stratum, the Rand Stratum pinches out to the south of a southeasterly trending line drawn from the vicinity of the Old St. Louis Road and West Date Street intersection to just north of the East Watkins and North Olive Street intersection. South of this boundary, the Rand Stratum and Main Sand form one hydrostratigraphic unit. To the north of Rand Avenue, the Rand Stratum was only found east of a projection of the North Market Street corridor beyond Rand Avenue. The Rand Stratum appears to be composed of less permeable deposits than the underlying Main Sand and EPA Stratum. Observations and analysis indicate the Rand is composed primarily of silt with lesser amounts of clay and trace amounts of sand. The Rand Stratum is present at depths ranging from 12 to 24 feet bgs (average elevation of 410 feet MSL) in the area of investigation (Figure 5-12). The Rand Stratum isopach reveals that the unit ranges in thickness from 0 to approximately 12 feet thick, with an average thickness of 6 feet (Figure 5-13). As indicated by the September 2004 mapping, the groundwater within the Rand Stratum also flows to the southwest within Hartford, though only the northeast portion of the Rand Stratum in Hartford was saturated. The groundwater within the Rand Stratum appears to become confined in the northeastern portion of Hartford.

The North Olive Stratum blankets the majority of the northern portion of Hartford extending, from the intersection of North Delmar Avenue with Old St. Louis Road (to the north of Hartford), south to Date Street (Figure 5-1). The North Olive Stratum extends along the Old St. Louis Road and North Olive Street corridors south of Date Street. However, south of Date Street, it is absent in the central portion of Hartford along the North Delmar Avenue and North Market Street corridors. The western extents have not been defined beyond the eastern side of Illinois State Route 3. It appears to extend slightly east of North Olive Street from Rand Avenue to the north to East Cherry Street to the south. The eastern extents have not been well defined south of East Cherry Street although it appears that the North Olive Stratum extends further to the east. As with the Rand, observations and analysis indicate the North Olive Stratum is composed primarily of silt with lesser amounts of clay and trace sand. The structural surface of the North Olive Stratum ranges from 8 to 16 feet bgs (average elevation of 419 feet MSL) in the area of investigation (Figure 5-14). The North Olive Stratum isopach (Figure 5-15) reveals that the stratum varies from 0 to approximately 10 feet thick. The North Olive Stratum, where present, generally ranges from approximately 2 to 4 feet thick across Hartford with the exception of the eastern edge of Hartford. The North Olive Stratum ranges up to approximately 10 feet thick near North Olive Street between East Forest and East Watkins Street and remains up to approximately 6 feet thick as far as East Cherry Street. As indicated by the September 2004 well gauging, the groundwater within the North Olive Stratum appears to consist of isolated areas of perched water.

The clay strata, overlying the North Olive Stratum, ranges from approximately 8 to 16 feet thick across Hartford (Figure 5-16). The thinnest portion of the clay strata, approximately 8 feet thick, is generally found along North Olive Street and Old St. Louis Road. The clay thickens to approximately 14 feet thick near West Cherry Street.

The alluvial clay and silt overlying the Main Sand ranges as thin as approximately 4 to 8 feet thick, in the southern end of northern Hartford in the vicinity of Forest Street

(Figure 5-17). It thickens to the north reaching approximately 26 feet in the central and northwestern portion of the northern end of Hartford.

5.2 GROUNDWATER FLOW MAPPING

Well gauging events were conducted from May to September 2004 to determine groundwater depths and apparent separate phase hydrocarbon thickness (if present) in order to allow evaluation of groundwater flow directions and delineate the current apparent horizontal and vertical extent of the separate phase hydrocarbon. Temporal variability (including precipitation and river-stage height) will influence data gathered from gauging events. Therefore, continued gauging needs to be conducted to evaluate these effects.

5.2.1 Evaluation of Monitoring Probes and Wells

Clayton has previously reviewed and evaluated available groundwater monitoring well and boring logs and accompanying groundwater elevation data for the remaining Hartford wells (installed prior to 2003), the Shell Rand Avenue and Tannery Property wells and the Premcor facility wells (Clayton 2004a, c). The reviews were to evaluate whether existing wells were appropriately constructed and screened for use in preparing representative groundwater flow maps of the saturated hydrostratigraphic units. As discussed in prior sections, the monitoring probes and wells installed in July and August 2004 were specifically screened within the identified more permeable units, specifically, the North Olive, Rand, and EPA Strata and the Main Sand. Therefore, the new probes (MP-series) and wells (HMW-series) have been incorporated into these previous well evaluation tables to summarize the wells identified as satisfactory for groundwater flow mapping of each strata, (if saturated). The tables also include the HSVE-series wells that were designed to screen multiple strata and, therefore, cannot be used for groundwater flow mapping. This information is presented in Table 5-1.

New and existing Hartford wells along with Premcor wells were used to develop the groundwater flow maps of the Main Sand with the Shell wells incorporated in the quarterly maps. Shell and Hartford wells were used to develop the groundwater flow maps of the EPA and Rand Strata while only Hartford wells were used to create a North Olive Stratum groundwater elevation map. However, as installation and development activities for the new Hartford probes and wells were not completed until early in September 2004, the groundwater flow mapping does not incorporate these monitoring locations until the September 2004 gauging event.

As discussed in previous reports (Clayton 2004c), the Premcor facility and the Shell wells, originally surveyed to a different datum than the Hartford wells, have been adjusted to match the USGS datum used for the Hartford wells.

5.2.2 May through August 2004 Groundwater Flow

Data from existing wells (pre-2003 installation) in Hartford and Premcor were used to develop groundwater flow maps of the Main Sand for this period. In mid July 2004, the Shell wells (Rand Avenue site and the Tannery property) were also gauged in cooperation with Shell's consultant, In-Control Technology of Houston, Texas as part of routine quarterly monitoring. This mid-July gauging enabled the creation of groundwater flow maps of the EPA and Rand Strata and enhanced mapping of the groundwater flow in the Main Sand. These July groundwater flow maps have been presented in the sentinel well monitoring report (Clayton 2004f) and are also included here. These additional Shell and Premcor wells are primarily located northeast and east of Hartford, respectively. Shell and Hartford wells were used to develop the groundwater flow map of the EPA Stratum during this period while only Shell wells were used to develop the groundwater flow map of the Rand Stratum. These maps are presented as Figures 5-18 through 5-25. Tables contained in Appendix F, present the results of the monitoring well gauging for 2004.

The May through August 2004 flow maps of the Main Sand show the groundwater flow direction is consistently northerly with varying easterly and westerly components (Figures 5-18, 5-19, 5-20, 5-23, 5-24, and 5-25). The flow direction was noted to have a strong easterly component at the end of June 2004 (Figure 5-19) with a return to a slight westerly component by the beginning of August (Figure 5-24). The westerly component had increased by the end of August 2004 (Figure 5-25). The observed easterly component was most pronounced when the Mississippi River stage was above 410 feet MSL with the flow returning to a more northerly direction when the stage was below 410 feet MSL. This overall northerly groundwater flow direction is consistent with historical interpretations. The natural movement of groundwater in the Hartford area has been altered by large-scale industrial water pumping resulting in the observed flow directions in the Main Sand (Clayton 2004a).

The mid July 2004 groundwater flow maps of both the EPA and the Rand Strata are more limited based on the limited areal extent of these respective strata and the limited number of monitoring points in these strata at the time of gauging. The mid July 2004 groundwater flow map (Figure 5-21) of the EPA Stratum indicated a groundwater divide that trends along a general east/west axis. The identified axis is located slightly east of the intersection of East Rand Avenue and North Olive Street. The flow to the north of this axis is generally northerly, while the flow to the south of the axis is southwesterly. Evidence of this hinge was also apparent in the April 2004 groundwater flow map of the EPA Stratum (Clayton 2004h). The southwesterly flow direction, south of the axis, is consistent with the January and April 2004 groundwater flow map of the EPA Stratum, though no hinge was observed in January 2004. The cause of the hinge line may be pumping activities in the Main Sand effecting flow in the EPA and Rand Stratum, given that the EPA and Rand Stratum are believed to pinch out into the Main Sand. Additional investigative activities would be required to determine if this is occurring.

The Rand Stratum (Figure 5-22) groundwater flow direction is generally northeasterly. The July 2004 flow direction is consistent with the January and April 2004 groundwater flow maps of the Rand Stratum (Clayton 2004c, h).

5.2.3 September 2004 Groundwater Flow

The September 2004 well gauging event was conducted at all of the existing and new monitoring well locations in Hartford. The well gauging, with the cooperation of Premcor, was extended to include the remaining accessible Premcor monitoring wells. The new and existing Hartford monitoring locations provided groundwater elevation data for the Main Sand and the EPA, Rand and North Olive Strata. However, groundwater flow maps were constructed from the September 20-22, 2004 gauging event for only three of the four identified hydrostratigraphic units, specifically, the Main Sand and the EPA and Rand Strata. Tables contained in Appendix F present the results of the 2004 monitoring well gauging for Hartford and the Premcor facility.

The gauging of the North Olive stratum (Figure 5-29) revealed only eight of the 34 probes/wells situated in this unit actually contained groundwater. These eight probes/wells were generally scattered throughout Hartford though four of the eight were near Rand Avenue. The review of the plotted groundwater elevations in these eight wells did not indicate the continuous presence of groundwater throughout the North Olive Stratum that would allow a determination of groundwater flow direction. The measured groundwater in these wells is considered to represent localized areas of perched water that are potentially seasonal or more ephemeral. Therefore, only an elevation map was created for the North Olive Stratum that simply presents the groundwater elevation data. Tables contained in Appendix F, present the results of the 2004 monitoring well gauging for Hartford and the Premcor facility.

The September 20-22, 2004 groundwater flow map of the Main Sand (Figure 5-26) indicates the flow direction, underlying Hartford, is generally northerly with a northwesterly trend becoming more pronounced at the northern end of Hartford. This flow direction is generally consistent with the 2004 groundwater flow maps of the Main Sand and historical interpretations provided by others. The Mississippi River stage elevation, measured at the Mel Price Tailwater (TW) Alton, Illinois gauging station on September 21, 2004, was 400.58 feet MSL. A review of the groundwater flow maps from May 27, June 30, July 13-14, July 28-29, August 11, August 25-27, and September 20-22, 2004 revealed that the Mississippi River stage has been steadily dropping since June, accompanied by a shifting of the groundwater flow underlying Hartford from a northeasterly to a northwesterly direction.

The September 20-22, 2004 groundwater flow maps of both the EPA Stratum and the Rand Stratum are not areally extensive based on the limited known extent of these respective strata. The groundwater flow map (Figure 5-27) of the EPA Stratum shows a west/southwesterly flow direction. This flow direction, underlying Hartford, is generally consistent with the January, April and July 2004 groundwater flow maps of the EPA Stratum. The previously identified groundwater divide (April and July 2004) in the EPA Stratum is not observed in the September flow map though this is likely a function of the exclusion of the Shell Rand Avenue wells. These excluded wells will be included in future well gauging events.

The Rand Stratum (Figure 5-28) groundwater flow direction is also southwesterly. This flow direction is not consistent with the generally northeasterly flow shown in the January, April and July 2004 groundwater flow maps. Again, this is likely a function of the exclusion of the Shell Rand Avenue wells. These excluded wells will be included in future well gauging events. It appears, based on earlier and current observations, that a similar groundwater divide, as seen in the EPA Stratum, will become apparent in the Rand Stratum, in the vicinity of Rand Avenue, with the inclusion of the Shell wells.

As previously suggested by Clayton (2004c), this investigation indicates that groundwater is not present throughout the entire extent of the Rand Stratum underlying Hartford. As a result, a continuous groundwater flow pattern, such as is seen in the Main Sand, does not appear to occur over the entirety of the Rand Stratum and it is considered unlikely to routinely occur (except under conditions such as an extreme rise in the groundwater when all of the hydrostratigraphic units may be in close hydraulic communication).

6.0 EVALUATION OF THE EXTENT AND DISTRIBUTION OF FREE PHASE HYDROCARBONS IN HARTFORD

The lateral extent of the LNAPL plume within Hartford has been defined by this investigation within the limitations posed by available public access right-of-ways and associated utilities.

6.1 SEPTEMBER 2004 LNAPL EXTENTS

In general, the LNAPL plume in the Main Sand, gauged in September 2004, correlates well with the interpreted extent of the plume based on an evaluation of the CPT/ROST investigation results (Clayton 2004c). Small, apparently localized, areas of separate phase hydrocarbon are found in both the EPA and Rand Strata with one in the EPA and two in the Rand. No separate phase hydrocarbon was observed in the North Olive Stratum.

The gauged extent of the LNAPL plume within the Main Sand in Hartford is presented in Figure 6-1 with the interpreted LNAPL plume extents within the EPA and Rand Strata shown in Figures 6-2 and 6-3, respectively.

The Main Sand LNAPL plume extent is generally bounded as follows:

- Rand Avenue to the north;
- North Olive Street to the east;
- E. Watkins Street to the south and;
- Old St. Louis Road to the west.

In September 2004, the LNAPL plume in the Main Sand was present at depths ranging from approximately 29 to 33 feet bgs and elevations ranging from approximately 401 to 398 feet MSL. The largest apparent separate phase hydrocarbon thickness, ranging above 2 feet, was observed on the eastern side of the northern portion of Hartford, generally

between East Cherry Street to the north, East Forest Street to the south and North Market Street to the west. The greatest apparent separate phase hydrocarbon thickness in this area was approximately 3.9 feet. This area is proximate to both the Elm Street and North Olive Street petroleum pipeline corridors.

The gauging, including events prior to the week of September 20, 2004, also identified the localized areas of separate phase hydrocarbon within the EPA and Rand Strata. The separate phase hydrocarbon within the EPA Stratum was present in the northeastern corner of Hartford near the intersection of North Olive Street and East Rand Avenue (Figure 6-2). In September 2004, the separate phase hydrocarbon identified in the EPA Stratum was present at approximately 27.5 feet bgs (401.6 feet MSL), the apparent thickness was approximately 3.8 feet. This area of separate phase hydrocarbon is proximate to the North Olive Street and the Rand Avenue petroleum pipeline corridors.

The Rand Stratum also contained two localized areas of separate phase hydrocarbon, one also present in the northeastern corner of Hartford and the second south of East Elm Street. The larger identified area (in the northeast corner) is interpreted to extend south from the intersection of North Olive Street and East Rand Avenue to the intersection of East Birch Street and North Market Street (Figure 6-3). The smaller interpreted area is north of the east/west trending alley between East Elm and East Forest Streets. The separate phase hydrocarbon, identified in the Rand Stratum in September 2004 in the northeast portion of Hartford, was encountered at depths ranging from approximately 14.7 feet bgs (414.5 feet MSL) to approximately 22.6 feet bgs (406.8 feet MSL), with an apparent thickness in the northeast portion of Hartford of approximately 0.5 feet or less. As observed in the EPA Stratum, the northernmost area of separate phase hydrocarbon in the Rand Stratum is proximate to the North Olive Street and Rand Avenue petroleum pipeline corridors. The southern area of separate phase hydrocarbon in the Rand Stratum has been little more than a sheen, $\leq$0.04 feet thick to date, at a depth of approximately

26.2 to 27 feet bgs (403.3 to 404.1 feet MSL). During September 20-22, the well evidencing this sheen was dry.

The presence of residual petroleum hydrocarbons, both within the North Olive Stratum (Clayton 2004c) and within certain utility corridors of Hartford, such as the sewer main on East Watkins Street, supports the initial Conceptual Site Model previously presented by Clayton (2004a, i). The presence of separate phase hydrocarbons in the utilities was identified as a potential source for vapor intrusion. The presence of shallow, more permeable strata (such as the North Olive Stratum) further serves as another potential pathway for vapor intrusion. The presence of the largest measured separate phase hydrocarbon thickness in the Main Sand, along with the separate phase hydrocarbon identified in the EPA and Rand Strata, all being near a petroleum pipeline corridor, point to the petroleum pipelines as primary sources of the identified separate phase hydrocarbon. This observation is supported by soil analytical data with the highest concentrations of petroleum hydrocarbons, specifically BETX, as being in or proximate to the petroleum pipeline corridors. Furthermore, the ROST investigation (Clayton 2004c), found the shallowest residual petroleum was again, proximate to the petroleum pipeline corridors, primarily the North Olive and Rand Avenue corridors. The ROST investigation has further identified the vertical extent of the residual phase hydrocarbon or smear zone as being as deep as 33 to almost 50 feet bgs at various locations throughout the site.

7.0 REFERENCES

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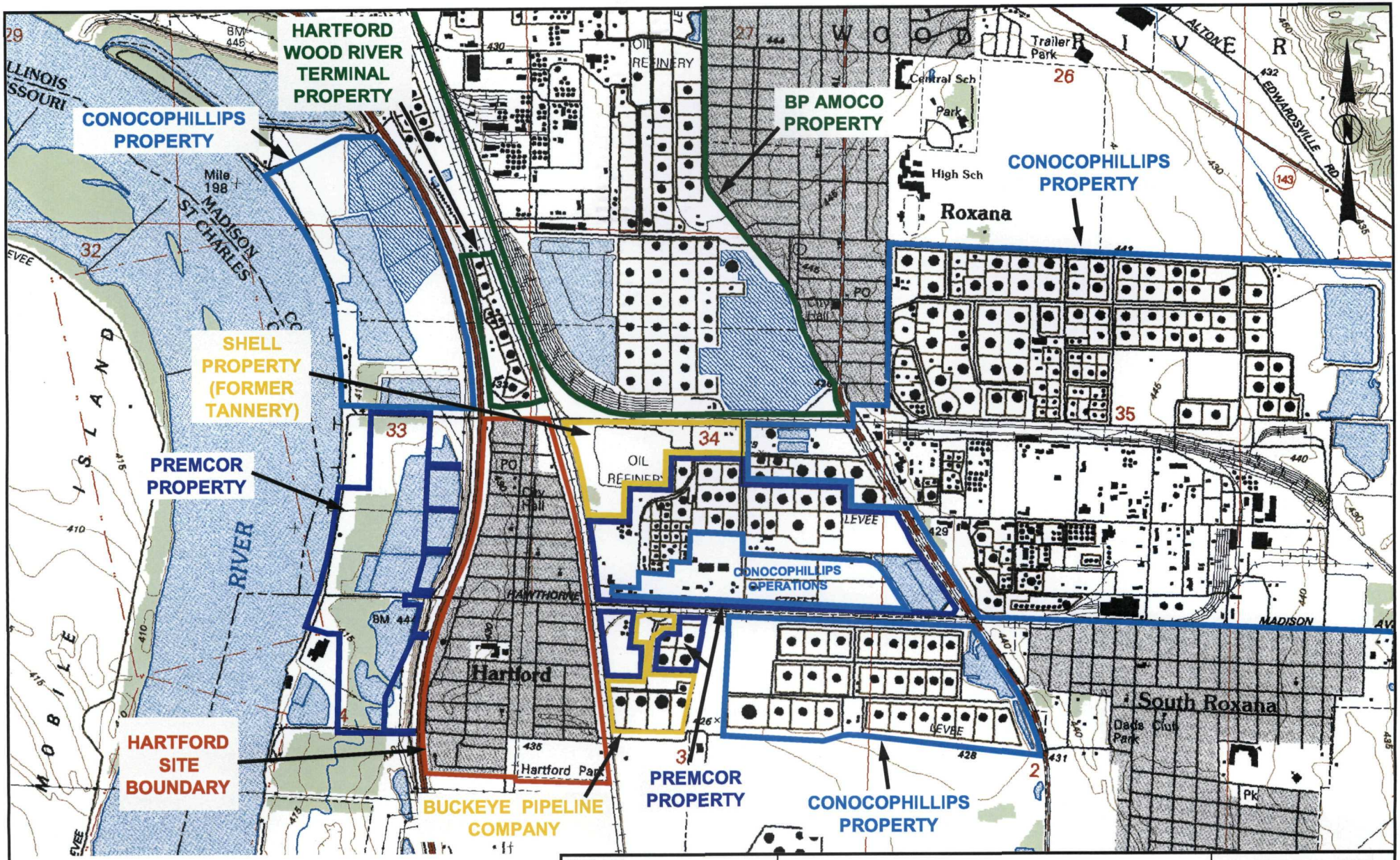
FIGURES



** NOT TO SCALE **

SOURCE:
USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP
(WOOD RIVER, ILL.–MO. – rev.1994)

CHK BY	
DWN BY	BCP
DATE	10–29–04
SCALE	AS SHOWN
CAD NO.	0309512001B
PRJ NO.	15–03095.14

VILLAGE OF HARTFORD, IL AND SURROUNDING AREA MAP

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
1–1

LEGEND:

- CPT/ROST™ INVESTIGATION LOCATION NO APPARENT PETROLEUM HYDROCARBON (BLACK)
- CPT/ROST™ INVESTIGATION LOCATION BLUE ROST RESPONSE
- CPT/ROST™ INVESTIGATION LOCATION GREEN ROST RESPONSE
- CPT/ROST™ INVESTIGATION LOCATION YELLOW ROST RESPONSE
- SENTINEL MONITORING WELLS
- EXISTING MONITORING WELL (HB, HMW, P, SP, RB)
- RECOVERY WELL (RW)
- PRODUCTION WELL (P)
- VAPOR CONTROL BORING (VCB)/ SOIL VAPOR EXTRACTION WELL (HSVE)
- PUBLIC WATER SUPPLY WELL (WSW)
- EXISTING PERMANENT SOIL VAPOR SAMPLING POINTS (MP, VP, VMP)
- S/M/D SHALLOW/MEDIUM/DEEP
- EXISTING PRAXAIR SAMPLING PROBE LOCATION
- TEST PIT (TP)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

DESIGN BY:	
CHECKED BY:	
DRAWN BY:	BCP
DATE:	10-29-04
SCALE:	AS SHOWN
CAD NO.:	0309514006A
PROJECT NO.:	15-03095.14

Clayton GROUP SERVICES

NORTH HARTFORD SITE MAP
VILLAGE OF HARTFORD, ILLINOIS

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

FIGURE

2-1

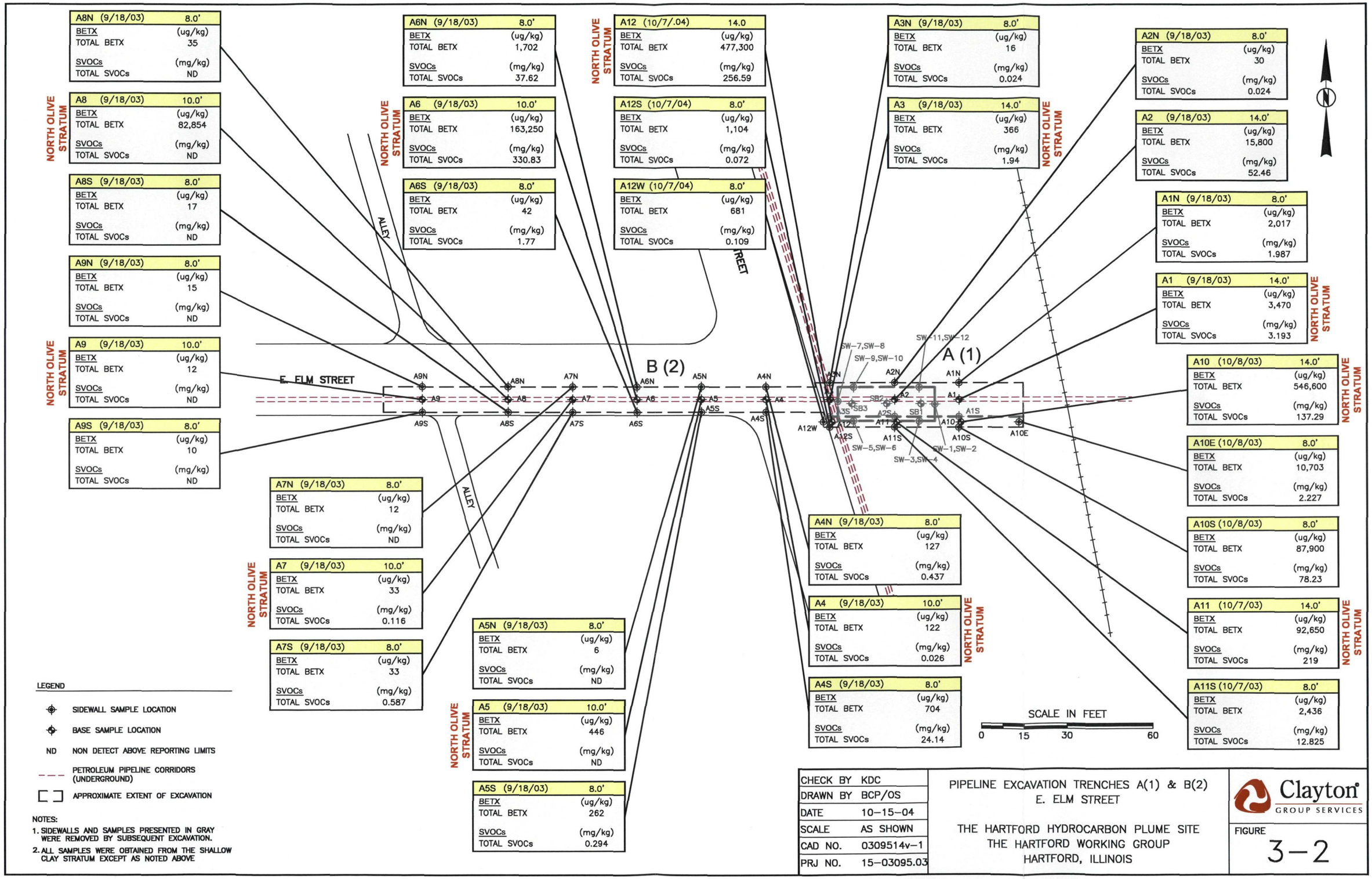
CHECK BY	
DRAWN BY	BCP
DATE	10–29–04
SCALE	AS SHOWN
CAD NO.	0309514006B
PRJ NO.	15–03095.14

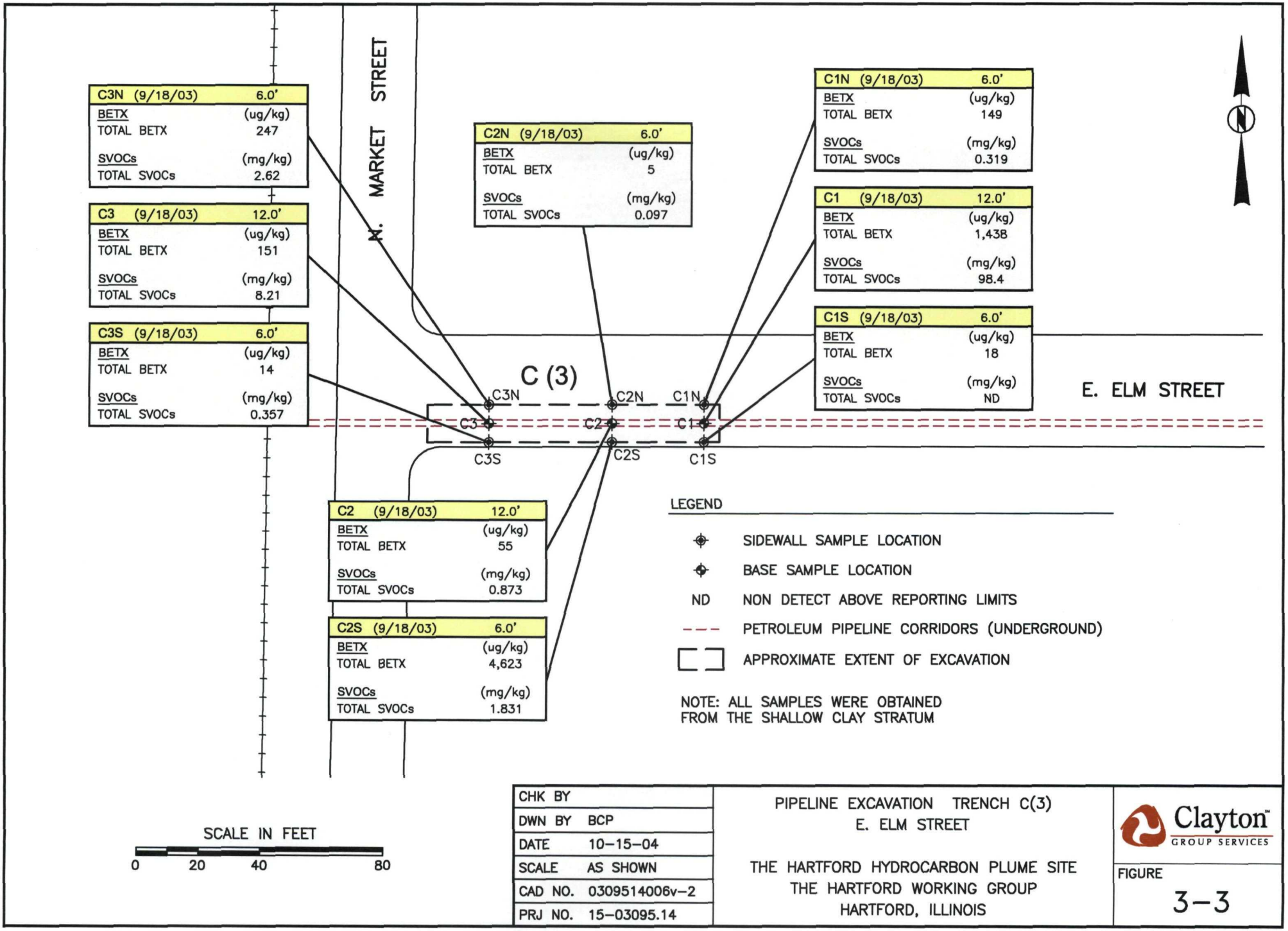
ELM STREET EXCAVATION PLAN VIEW – 2003

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
3–1


A8N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 35
SVOCs (mg/kg)
TOTAL SVOCs ND
A8 (9/18/03) 10.0'
BETX (ug/kg)
TOTAL BETX 82,854
SVOCs (mg/kg)
TOTAL SVOCs ND
A8S (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 17
SVOCs (mg/kg)
TOTAL SVOCs ND
A9N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 15
SVOCs (mg/kg)
TOTAL SVOCs ND
A9 (9/18/03) 10.0'
BETX (ug/kg)
TOTAL BETX 12
SVOCs (mg/kg)
TOTAL SVOCs ND
A9S (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 10
SVOCs (mg/kg)
TOTAL SVOCs ND
NORTH OLIVE STRATUM
A6N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 1,702
SVOCs (mg/kg)
TOTAL SVOCs 37.62
A6 (9/18/03) 10.0'
BETX (ug/kg)
TOTAL BETX 163,250
SVOCs (mg/kg)
TOTAL SVOCs 330.83
A6S (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 42
SVOCs (mg/kg)
TOTAL SVOCs 1.77
ALLEY
A12 (10/7/.04) 14.0
BETX (ug/kg)
TOTAL BETX 477,300
SVOCs (mg/kg)
TOTAL SVOCs 256.59
A12S (10/7/04) 8.0'
BETX (ug/kg)
TOTAL BETX 1,104
SVOCs (mg/kg)
TOTAL SVOCs 0.072
A12W (10/7/04) 8.0'
BETX (ug/kg)
TOTAL BETX 681
SVOCs (mg/kg)
TOTAL SVOCs 0.109
A3N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 16
SVOCs (mg/kg)
TOTAL SVOCs 0.024
A3 (9/18/03) 14.0'
BETX (ug/kg)
TOTAL BETX 366
SVOCs (mg/kg)
TOTAL SVOCs 1.94
A2N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 30
SVOCs (mg/kg)
TOTAL SVOCs 0.024
A2 (9/18/03) 14.0'
BETX (ug/kg)
TOTAL BETX 15,800
SVOCs (mg/kg)
TOTAL SVOCs 52.46
A1N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 2,017
SVOCs (mg/kg)
TOTAL SVOCs 1.987
A1 (9/18/03) 14.0'
BETX (ug/kg)
TOTAL BETX 3,470
SVOCs (mg/kg)
TOTAL SVOCs 3.193
A10 (10/8/03) 14.0'
BETX (ug/kg)
TOTAL BETX 546,600
SVOCs (mg/kg)
TOTAL SVOCs 137.29
A10E (10/8/03) 8.0'
BETX (ug/kg)
TOTAL BETX 10,703
SVOCs (mg/kg)
TOTAL SVOCs 2.227
A10S (10/8/03) 8.0'
BETX (ug/kg)
TOTAL BETX 87,900
SVOCs (mg/kg)
TOTAL SVOCs 78.23
A11 (10/7/03) 14.0'
BETX (ug/kg)
TOTAL BETX 92,650
SVOCs (mg/kg)
TOTAL SVOCs 219
A11S (10/7/03) 8.0'
BETX (ug/kg)
TOTAL BETX 2,436
SVOCs (mg/kg)
TOTAL SVOCs 12.825
A7N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 12
SVOCs (mg/kg)
TOTAL SVOCs ND
A7 (9/18/03) 10.0'
BETX (ug/kg)
TOTAL BETX 33
SVOCs (mg/kg)
TOTAL SVOCs 0.116
A7S (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 33
SVOCs (mg/kg)
TOTAL SVOCs 0.587
A5N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 6
SVOCs (mg/kg)
TOTAL SVOCs ND
A5 (9/18/03) 10.0'
BETX (ug/kg)
TOTAL BETX 446
SVOCs (mg/kg)
TOTAL SVOCs ND
A5S (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 262
SVOCs (mg/kg)
TOTAL SVOCs 0.294
A4N (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 127
SVOCs (mg/kg)
TOTAL SVOCs 0.437
A4 (9/18/03) 10.0'
BETX (ug/kg)
TOTAL BETX 122
SVOCs (mg/kg)
TOTAL SVOCs 0.026
A4S (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 704
SVOCs (mg/kg)
TOTAL SVOCs 24.14
E. ELM STREET
B (2)
A (1)
A9N
A9
A9S
A8N
A8
A8S
A7N
A7
A7S
A6N
A6
A6S
A5N
A5
A5S
A4N
A4
A4S
A3N
A3
A3S
A2N
A2
A2S
A1N
A1
A1S
A12W
A12
A12S
A11S
A10S
A10E
SB1
SB2
SB3
SW-1,SW-2
SW-3,SW-4
SW-5,SW-6
SW-7,SW-8
SW-9,SW-10
SW-11,SW-12
N
SCALE IN FEET
0 15 30 60
LEGEND
SIDEWALL SAMPLE LOCATION
BASE SAMPLE LOCATION
ND NON DETECT ABOVE REPORTING LIMITS
PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
APPROXIMATE EXTENT OF EXCAVATION
NOTES:
1. SIDEWALLS AND SAMPLES PRESENTED IN GRAY WERE REMOVED BY SUBSEQUENT EXCAVATION.
2. ALL SAMPLES WERE OBTAINED FROM THE SHALLOW CLAY STRATUM EXCEPT AS NOTED ABOVE
CHECK BY KDC
DRAWN BY BCP/OS
DATE 10-15-04
SCALE AS SHOWN
CAD NO. 0309514v-1
PRJ NO. 15-03095.03
PIPELINE EXCAVATION TRENCHES A(1) & B(2)
E. ELM STREET
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS
Clayton GROUP SERVICES
FIGURE
3-2



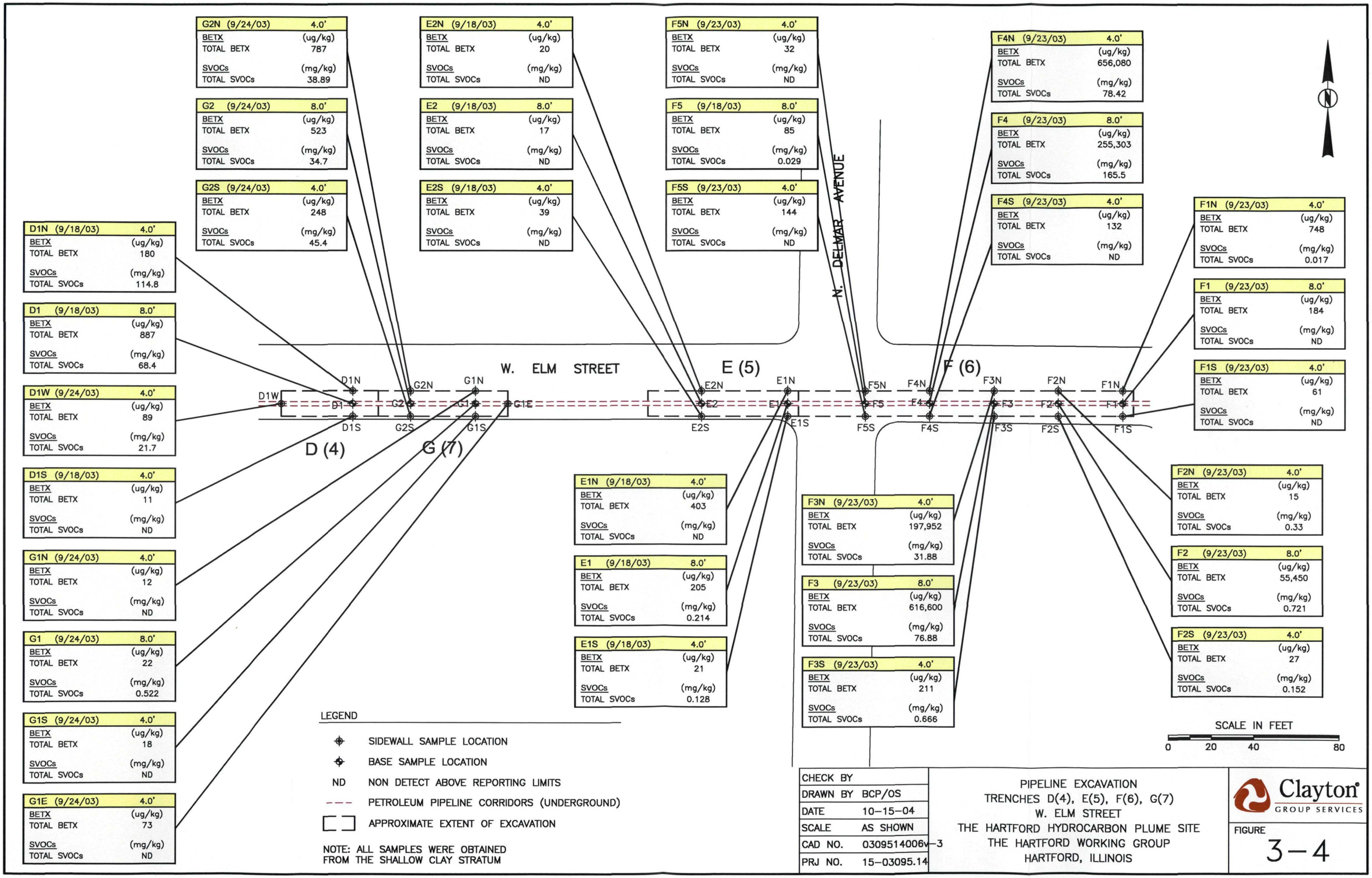
CHK BY	
DWN BY	BCP
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309514006v-2
PRJ NO.	15-03095.14

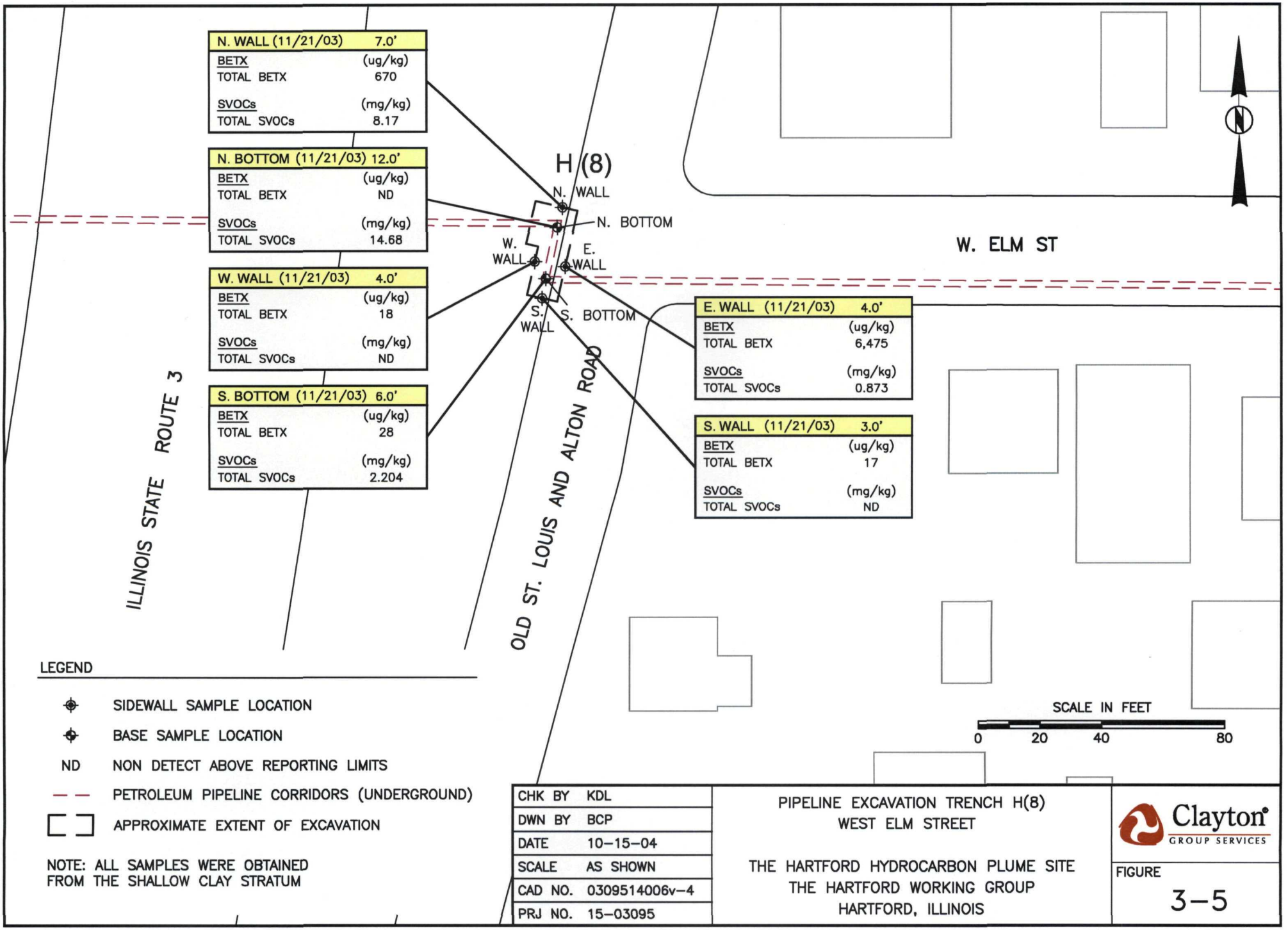
PIPELINE EXCAVATION TRENCH C(3)
E. ELM STREET

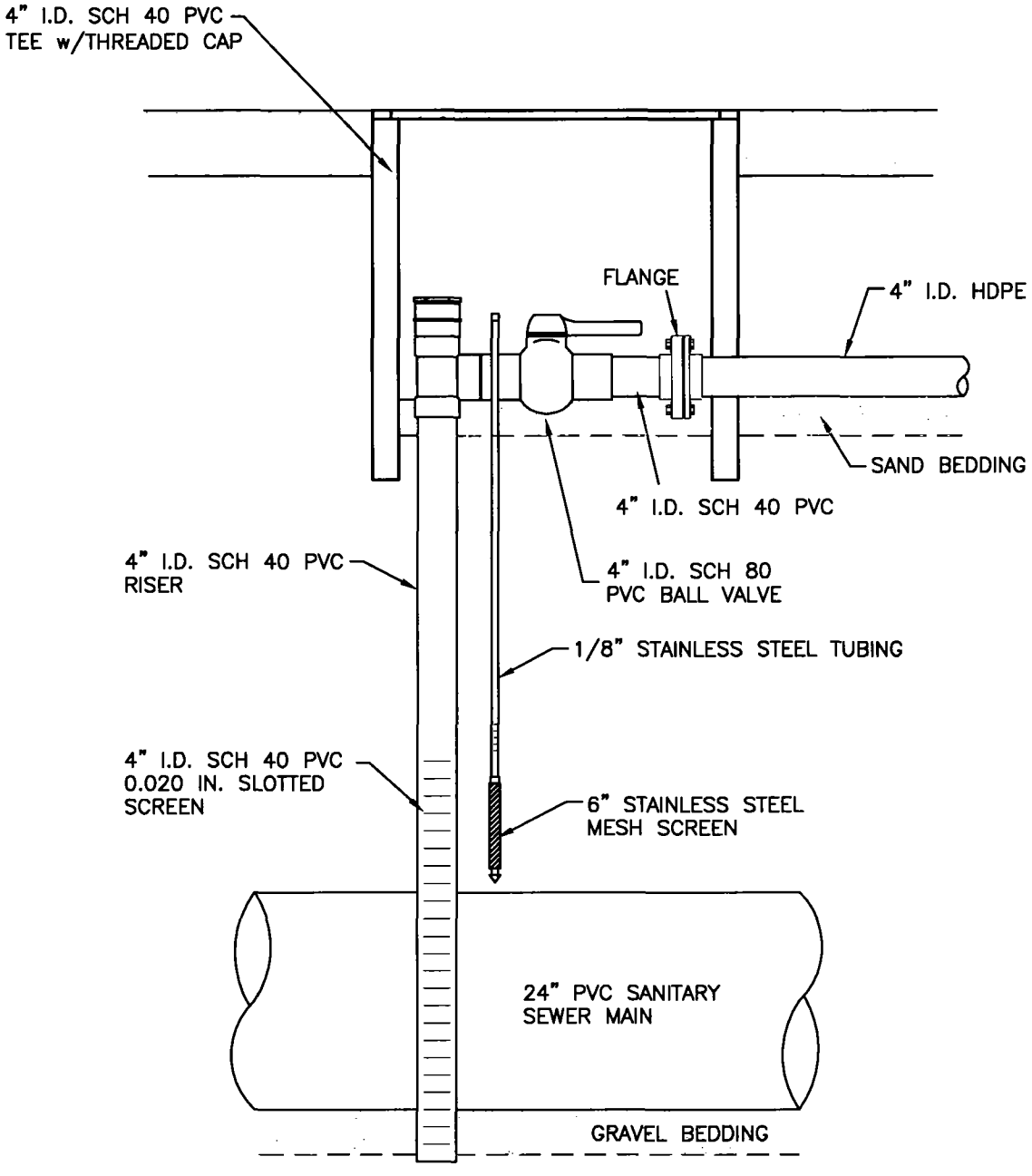
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
3-3


G2N (9/24/03) 4.0'
BETX (ug/kg)
TOTAL BETX 787
SVOCs (mg/kg)
TOTAL SVOCs 38.89
G2 (9/24/03) 8.0'
BETX (ug/kg)
TOTAL BETX 523
SVOCs (mg/kg)
TOTAL SVOCs 34.7
G2S (9/24/03) 4.0'
BETX (ug/kg)
TOTAL BETX 248
SVOCs (mg/kg)
TOTAL SVOCs 45.4
E2N (9/18/03) 4.0'
BETX (ug/kg)
TOTAL BETX 20
SVOCs (mg/kg)
TOTAL SVOCs ND
E2 (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 17
SVOCs (mg/kg)
TOTAL SVOCs ND
E2S (9/18/03) 4.0'
BETX (ug/kg)
TOTAL BETX 39
SVOCs (mg/kg)
TOTAL SVOCs ND
F5N (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 32
SVOCs (mg/kg)
TOTAL SVOCs ND
F5 (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 85
SVOCs (mg/kg)
TOTAL SVOCs 0.029
F5S (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 144
SVOCs (mg/kg)
TOTAL SVOCs ND
F4N (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 656,080
SVOCs (mg/kg)
TOTAL SVOCs 78.42
F4 (9/23/03) 8.0'
BETX (ug/kg)
TOTAL BETX 255,303
SVOCs (mg/kg)
TOTAL SVOCs 165.5
F4S (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 132
SVOCs (mg/kg)
TOTAL SVOCs ND
N. DELMAR AVENUE
D1N (9/18/03) 4.0'
BETX (ug/kg)
TOTAL BETX 180
SVOCs (mg/kg)
TOTAL SVOCs 114.8
D1 (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 887
SVOCs (mg/kg)
TOTAL SVOCs 68.4
D1W (9/24/03) 4.0'
BETX (ug/kg)
TOTAL BETX 89
SVOCs (mg/kg)
TOTAL SVOCs 21.7
D1S (9/18/03) 4.0'
BETX (ug/kg)
TOTAL BETX 11
SVOCs (mg/kg)
TOTAL SVOCs ND
G1N (9/24/03) 4.0'
BETX (ug/kg)
TOTAL BETX 12
SVOCs (mg/kg)
TOTAL SVOCs ND
G1 (9/24/03) 8.0'
BETX (ug/kg)
TOTAL BETX 22
SVOCs (mg/kg)
TOTAL SVOCs 0.522
G1S (9/24/03) 4.0'
BETX (ug/kg)
TOTAL BETX 18
SVOCs (mg/kg)
TOTAL SVOCs ND
G1E (9/24/03) 4.0'
BETX (ug/kg)
TOTAL BETX 73
SVOCs (mg/kg)
TOTAL SVOCs ND
W. ELM STREET
D (4)
G (7)
E (5)
F (6)
D1N
G2N
G1N
D1W
D1
G2
G1
G1E
D1S
G2S
G1S
E2N
E1N
F5N
F4N
F3N
F2N
F1N
E2
E1
F5
F4
F3
F2
F1
E2S
E1S
F5S
F4S
F3S
F2S
F1S
E1N (9/18/03) 4.0'
BETX (ug/kg)
TOTAL BETX 403
SVOCs (mg/kg)
TOTAL SVOCs ND
E1 (9/18/03) 8.0'
BETX (ug/kg)
TOTAL BETX 205
SVOCs (mg/kg)
TOTAL SVOCs 0.214
E1S (9/18/03) 4.0'
BETX (ug/kg)
TOTAL BETX 21
SVOCs (mg/kg)
TOTAL SVOCs 0.128
F3N (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 197,952
SVOCs (mg/kg)
TOTAL SVOCs 31.88
F3 (9/23/03) 8.0'
BETX (ug/kg)
TOTAL BETX 616,600
SVOCs (mg/kg)
TOTAL SVOCs 76.88
F3S (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 211
SVOCs (mg/kg)
TOTAL SVOCs 0.666
F1N (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 748
SVOCs (mg/kg)
TOTAL SVOCs 0.017
F1 (9/23/03) 8.0'
BETX (ug/kg)
TOTAL BETX 184
SVOCs (mg/kg)
TOTAL SVOCs ND
F1S (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 61
SVOCs (mg/kg)
TOTAL SVOCs ND
F2N (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 15
SVOCs (mg/kg)
TOTAL SVOCs 0.33
F2 (9/23/03) 8.0'
BETX (ug/kg)
TOTAL BETX 55,450
SVOCs (mg/kg)
TOTAL SVOCs 0.721
F2S (9/23/03) 4.0'
BETX (ug/kg)
TOTAL BETX 27
SVOCs (mg/kg)
TOTAL SVOCs 0.152
N
SCALE IN FEET
0 20 40 80
LEGEND
SIDEWALL SAMPLE LOCATION
BASE SAMPLE LOCATION
ND NON DETECT ABOVE REPORTING LIMITS
PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
APPROXIMATE EXTENT OF EXCAVATION
NOTE: ALL SAMPLES WERE OBTAINED FROM THE SHALLOW CLAY STRATUM
CHECK BY
DRAWN BY BCP/OS
DATE 10-15-04
SCALE AS SHOWN
CAD NO. 0309514006v-3
PRJ NO. 15-03095.14
PIPELINE EXCAVATION
TRENCHES D(4), E(5), F(6), G(7)
W. ELM STREET
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS
Clayton GROUP SERVICES
FIGURE
3-4


N. WALL (11/21/03) 7.0'
BETX (ug/kg)
TOTAL BETX 670
SVOCs (mg/kg)
TOTAL SVOCs 8.17
N. BOTTOM (11/21/03) 12.0'
BETX (ug/kg)
TOTAL BETX ND
SVOCs (mg/kg)
TOTAL SVOCs 14.68
W. WALL (11/21/03) 4.0'
BETX (ug/kg)
TOTAL BETX 18
SVOCs (mg/kg)
TOTAL SVOCs ND
S. BOTTOM (11/21/03) 6.0'
BETX (ug/kg)
TOTAL BETX 28
SVOCs (mg/kg)
TOTAL SVOCs 2.204
E. WALL (11/21/03) 4.0'
BETX (ug/kg)
TOTAL BETX 6,475
SVOCs (mg/kg)
TOTAL SVOCs 0.873
S. WALL (11/21/03) 3.0'
BETX (ug/kg)
TOTAL BETX 17
SVOCs (mg/kg)
TOTAL SVOCs ND
H (8)
N. WALL
N. BOTTOM
W. WALL
E. WALL
S. WALL
S. BOTTOM
W. ELM ST
ILLINOIS STATE ROUTE 3
OLD ST. LOUIS AND ALTON ROAD
N
SCALE IN FEET
0 20 40 80
LEGEND
SIDEWALL SAMPLE LOCATION
BASE SAMPLE LOCATION
ND NON DETECT ABOVE REPORTING LIMITS
PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
APPROXIMATE EXTENT OF EXCAVATION
NOTE: ALL SAMPLES WERE OBTAINED FROM THE SHALLOW CLAY STRATUM
CHK BY KDL
DWN BY BCP
DATE 10-15-04
SCALE AS SHOWN
CAD NO. 0309514006v-4
PRJ NO. 15-03095
PIPELINE EXCAVATION TRENCH H(8)
WEST ELM STREET
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS
Clayton GROUP SERVICES
FIGURE
3-5



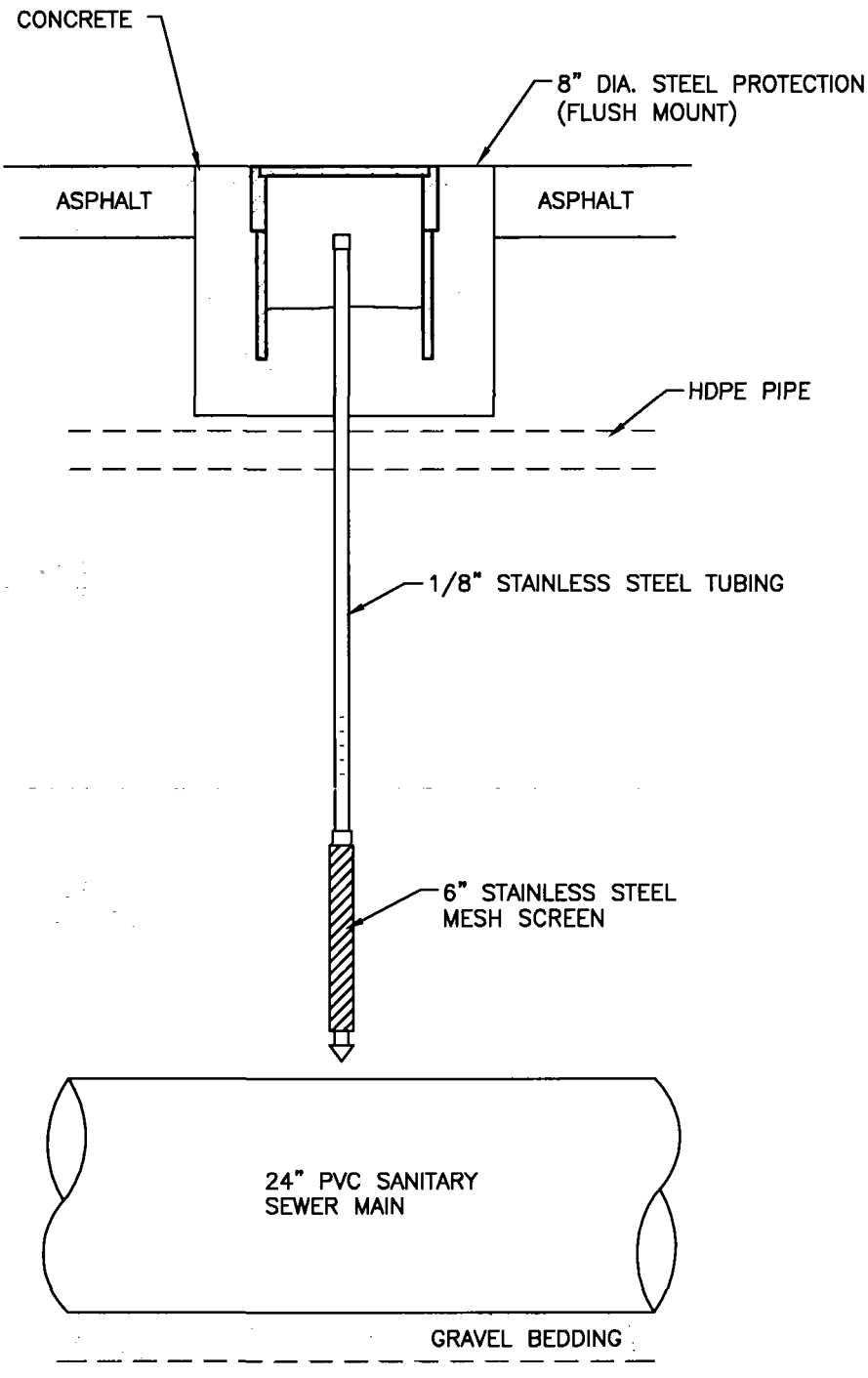
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-04
SCALE	NOT TO SCALE
CAD NO.	0309514002as-blt
PRJ NO.	15-03095.14

SHALLOW SVE WELL INSTALLATION SCHEMATIC
EAST WATKINS STREET SEWER BACKFILL

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
3-6



CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-04
SCALE	NOT TO SCALE
CAD NO.	0309514002as-blt
PRJ NO.	15-03095.14

VAPOR MONITORING POINT INSTALLATION SCHEMATIC
EAST WATKINS STREET SEWER BACKFILL

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
3-7

HMW-46 (8/2/04)	12.0'–14.0'
BETX/MTBE	(ug/kg)
BENZENE	3,220
ETHYLBENZENE	2,090
TOLUENE	55 J
TOTAL XYLENES	1,750 J
MTBE	<74
TOTAL BETX	7,115
METALs	(mg/kg)
ARSENIC	6.89

HMW-45 (8/4/04)	12.0'–14.0'
BETX/MTBE	(ug/kg)
BENZENE	31.1
ETHYLBENZENE	2.5 J
TOLUENE	4.8 J
TOTAL XYLENES	9.2
MTBE	<2.4
TOTAL BETX	47.6
METALs	(mg/kg)
LEAD	14.4

HMW-47 (8/2/04)	14.0'–16.0'
BETX/MTBE	(ug/kg)
BENZENE	2.1
ETHYLBENZENE	<9.1
TOLUENE	2.6 J
TOTAL XYLENES	6.9 J
MTBE	<3.7
TOTAL BETX	11.6
METALs	(mg/kg)
LEAD	20.2
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-38 (8/3/04)	12.0'–14.0'
BETX/MTBE	(ug/kg)
BENZENE	228
ETHYLBENZENE	<153
TOLUENE	<153
TOTAL XYLENES	42 J
MTBE	<61.1
TOTAL BETX	270
METALs	(mg/kg)
ARSENIC	13.6

HMW-48 (8/2/04)	12.0'–14.0'
BETX/MTBE	(ug/kg)
BENZENE	20,500
ETHYLBENZENE	37,000
TOLUENE	1,020
TOTAL XYLENES	105,000
MTBE	<253
TOTAL BETX	163,520
METALs	(mg/kg)
LEAD	13.5

HMW-39 (8/30/04)	14.0'–15.0'	DUP-01
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	3.2	3
ETHYLBENZENE	1.5 J	1.2 J
TOLUENE	6.6 J	5.6 J
TOTAL XYLENES	6.3 J	5.2 J
MTBE	<2.8	<2.5
TOTAL BETX	17.6	15
METALs	(mg/kg)	(mg/kg)
LEAD	8.37	9.49

MP-47 (7/13/04)	10.0'
BETX/MTBE	(ug/kg)
BENZENE	0.6 J
ETHYLBENZENE	1.7 J
TOLUENE	3.2 J
TOTAL XYLENES	7.1 J
MTBE	<2.3
TOTAL BETX	12.6
METALs	(mg/kg)
LEAD	13.3
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-40 (8/3/04)	12.0'–14.0'
BETX/MTBE	(ug/kg)
BENZENE	4.7
ETHYLBENZENE	2.8 J
TOLUENE	10.2
TOTAL XYLENES	7.5
MTBE	<2.5
TOTAL BETX	25.2
METALs	(mg/kg)
LEAD	9.33

MP-55 (7/16/04)	12.0'
BETX/MTBE	(ug/kg)
BENZENE	179
ETHYLBENZENE	120 J
TOLUENE	172
TOTAL XYLENES	664 J
MTBE	<54.8
TOTAL BETX	1,135
METALs	(mg/kg)
LEAD	13.9
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-51 (8/3/04)	10.0'–12.0'
BETX/MTBE	(ug/kg)
BENZENE	3.3
ETHYLBENZENE	1.8 J
TOLUENE	5.5 J
TOTAL XYLENES	4.6 J
MTBE	<3
TOTAL BETX	15.2
METALs	(mg/kg)
LEAD	11.2

HMW-44 (8/5/04)	10.0'–12.0'	DUP-04
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	33,900	27,700
ETHYLBENZENE	81,000	101,000
TOLUENE	146,000	149,000
TOTAL XYLENES	321,000	412,000
MTBE	<2,920	<2,880
TOTAL BETX	581,900	689,700
METALs	(mg/kg)	(mg/kg)
LEAD	13.8	11.4

HMW-41 (8/4/04)	15.0'–16.0'
BETX/MTBE	(ug/kg)
BENZENE	6.1
ETHYLBENZENE	7.9 J
TOLUENE	16.5
TOTAL XYLENES	19.7
MTBE	<6.0
TOTAL BETX	50.2
METALs	(mg/kg)
LEAD	10.6

VMP-15 (9/2/04)	12.5'
BETX/MTBE	(ug/kg)
BENZENE	17,900
ETHYLBENZENE	57,200
TOLUENE	58,500
TOTAL XYLENES	219,000
MTBE	<1,210
TOTAL BETX	352,600

HMW-43 (8/23/04)	12.0'–14.0'
BETX/MTBE	(ug/kg)
BENZENE	1,060
ETHYLBENZENE	34,900
TOLUENE	17,300
TOTAL XYLENES	177,000
MTBE	<292
TOTAL BETX	230,260
METALs	(mg/kg)
LEAD	7.15

LEGEND:

- • MONITORING PROBE/WELL LOCATION
- ND NON DETECT ABOVE REPORTING LIMITS
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- INTERPRETED EXTENT OF RESIDUAL PETROLEUM HYDROCARBON ENCOUNTERED BY ROST IN THE N. OLIVE STRATUM (APPROX. AVERAGE DEPTHS OF 11' TO 14')
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006F
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM
THE N. OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4–1

MP-29 (7/12/04)	16.0'
BETX/MTBE	(ug/kg)
BENZENE	17
ETHYLBENZENE	2.5
TOLUENE	5.1
TOTAL XYLENES	7.2
MTBE	<2.3
TOTAL BETX	31.8
METALs	(mg/kg)
LEAD	16.4

HMW-48 (8/2/04)	22.0'–24.0'
BETX/MTBE	(ug/kg)
BENZENE	33,600
ETHYLBENZENE	33,000
TOLUENE	1,130
TOTAL XYLENES	95,930
MTBE	<111
TOTAL BETX	163,660
METALs	(mg/kg)
LEAD	12.4
SVOCs	(mg/kg)
TOTAL SVOCs	4.6

MP-47 (7/13/04)	20.0'
BETX/MTBE	(ug/kg)
BENZENE	8,550
ETHYLBENZENE	156,000
TOLUENE	277,000
TOTAL XYLENES	1,498,000
MTBE	<3,810
TOTAL BETX	1,939,550
METALs	(mg/kg)
LEAD	17.3
SVOCs	(mg/kg)
TOTAL SVOCs	1.95

MP-34 (7/19/04)	19.5'
BETX/MTBE	(ug/kg)
BENZENE	1.5
ETHYLBENZENE	2.1 J
TOLUENE	3.8 J
TOTAL XYLENES	6.2
MTBE	<2.1
TOTAL BETX	13.6
METALs	(mg/kg)
LEAD	15.6

MP-55 (7/16/04)	20.0'
BETX/MTBE	(ug/kg)
BENZENE	94,600
ETHYLBENZENE	85,000
TOLUENE	299,000
TOTAL XYLENES	368,000
MTBE	<1,060
TOTAL BETX	846,600
METALs	(mg/kg)
LEAD	13.2
SVOCs	(mg/kg)
TOTAL SVOCs	9.4

MP-53 (7/15/04)	19.5'
BETX/MTBE	(ug/kg)
BENZENE	2,090
ETHYLBENZENE	170,000
TOLUENE	<5,540
TOTAL XYLENES	259,000
MTBE	<2,220
TOTAL BETX	431,090
METALs	(mg/kg)
LEAD	29.7

HMW-44 (8/5/04)	20.0'–22.0'
BETX/MTBE	(ug/kg)
BENZENE	293,000
ETHYLBENZENE	310,000
TOLUENE	997,000
TOTAL XYLENES	1,304,000
MTBE	<1,400
TOTAL BETX	2,904,000
METALs	(mg/kg)
LEAD	23.7
SVOCs	(mg/kg)
TOTAL SVOCs	52.7

LEGEND:

- • MONITORING PROBE/WELL LOCATION
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- INTERPRETED EXTENT OF RESIDUAL PETROLEUM HYDROCARBON ENCOUNTERED BY ROST IN THE MAIN SAND (ABOVE 25')
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

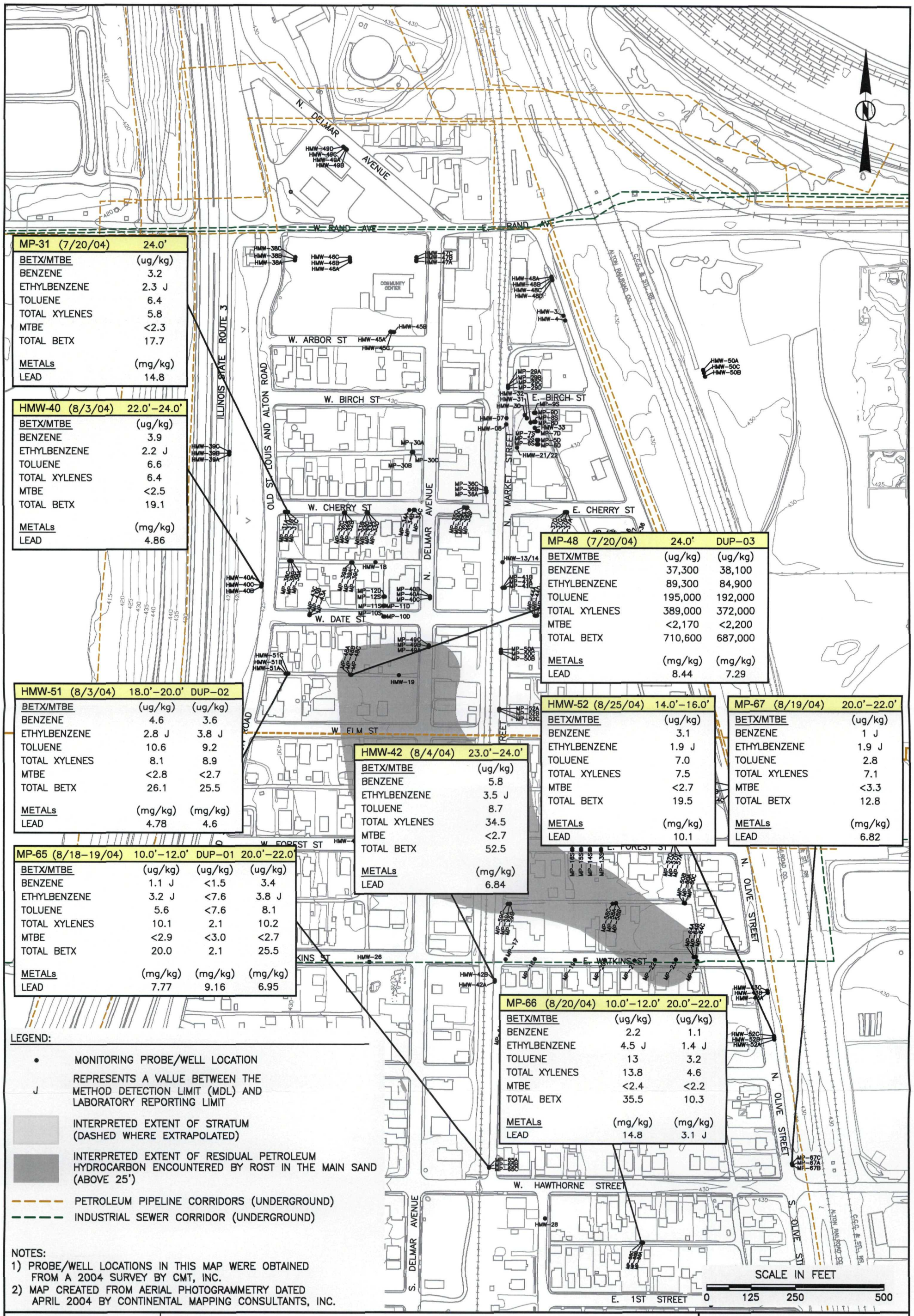
CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9-22-04
SCALE	AS SHOWN
CAD NO.	0309514006L
PRJ NO.	15-03095

SOIL ANALYSIS RESULTS FROM THE
THE RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4-2



CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006Q
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM THE MAIN SAND

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 4–3

HMW-46 (8/2/04)	8.0'–10.0'
BETX/MTBE	(ug/kg)
BENZENE	2,160
ETHYLBENZENE	346
TOLUENE	<156
TOTAL XYLENES	442
MTBE	<62.3
TOTAL BETX	2,948
METALs	(mg/kg)
LEAD	12.8

HMW-49 (8/24/04)	7.0'–9.0'
BETX/MTBE	(ug/kg)
BENZENE	<1.0
ETHYLBENZENE	<5.1
TOLUENE	<5.1
TOTAL XYLENES	1.7 J
MTBE	<2.0
TOTAL BETX	1.7
METALs	(mg/kg)
LEAD	15

HMW-47 (8/2/04)	10.0'–12.0'
BETX/MTBE	(ug/kg)
BENZENE	2.1
ETHYLBENZENE	1.1 J
TOLUENE	1 J
TOTAL XYLENES	3.9 J
MTBE	<2.0
TOTAL BETX	8.1
METALs	(mg/kg)
LEAD	14

HMW-45 (8/4/04)	10.0'–12.0'
BETX/MTBE	(ug/kg)
BENZENE	135
ETHYLBENZENE	<162
TOLUENE	47 J
TOTAL XYLENES	53 J
MTBE	<64.9
TOTAL BETX	235
METALs	(mg/kg)
LEAD	20.4

HMW-48 (8/2/04)	6.0'–8.0'
BETX/MTBE	(ug/kg)
BENZENE	28,400
ETHYLBENZENE	136,000
TOLUENE	2,270
TOTAL XYLENES	277,000
MTBE	<545
TOTAL BETX	443,670
METALs	(mg/kg)
LEAD	14.6

HMW-38 (8/3/04)	6.0'–8.0'
BETX/MTBE	(ug/kg)
BENZENE	184
ETHYLBENZENE	<151
TOLUENE	<151
TOTAL XYLENES	53 J
MTBE	<60.2
TOTAL BETX	237
METALs	(mg/kg)
LEAD	16

MP-29 (7/12/04)	7.5'
BETX/MTBE	(ug/kg)
BENZENE	2.3
ETHYLBENZENE	<5.8
TOLUENE	<5.8
TOTAL XYLENES	1.6 J
MTBE	<2.3
TOTAL BETX	3.9
METALs	(mg/kg)
LEAD	16.7

HMW-39 (8/30/04)	6.0'–8.0'	8.0'–10.0'	12.0'–13.0'
BETX/MTBE	(ug/kg)	(ug/kg)	(ug/kg)
BENZENE	1.4 J	0.7 J	0.8 J
ETHYLBENZENE	<7.7	<7.3	<7.5
TOLUENE	1.7 J	1.8 J	<7.5
TOTAL XYLENES	2.7 J	<7.3	<7.5
MTBE	<3.1	<2.9	<3.0
TOTAL BETX	5.8	2.5	0.8
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	30.2	45	10.8

MP-34 (7/19/04)	13.5'
BETX/MTBE	(ug/kg)
BENZENE	1.2
ETHYLBENZENE	0.9 J
TOLUENE	2.8 J
TOTAL XYLENES	3.4
MTBE	<1.2
TOTAL BETX	8.3
METALs	(mg/kg)
LEAD	17

MP-31 (7/20/04)	12.0'	DUP-02
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	3.8	3.9
ETHYLBENZENE	4.2 J	3.4 J
TOLUENE	13.2	12.5
TOTAL XYLENES	12.4	10.4
MTBE	<3	<2.2
TOTAL BETX	33.6	30.2
METALs	(mg/kg)	(mg/kg)
LEAD	13.5	11.5

MP-47 (7/13/04)	7.0'
BETX/MTBE	(ug/kg)
BENZENE	0.8 J
ETHYLBENZENE	1.3 J
TOLUENE	3.9 J
TOTAL XYLENES	5.4 J
MTBE	<2.1
TOTAL BETX	11.4
METALs	(mg/kg)
LEAD	16.1

HMW-51 (8/3/04)	8.0'–10.0'
BETX/MTBE	(ug/kg)
BENZENE	4.2
ETHYLBENZENE	2.1 J
TOLUENE	6.8 J
TOTAL XYLENES	6.9 J
MTBE	<3.8
TOTAL BETX	20.0
METALs	(mg/kg)
LEAD	12.8

HMW-44 (8/5/04)	6.0'–8.0'
BETX/MTBE	(ug/kg)
BENZENE	85,000
ETHYLBENZENE	267,000
TOLUENE	3,200 J
TOTAL XYLENES	31,900
MTBE	<5,370
TOTAL BETX	387,100
METALs	(mg/kg)
LEAD	20.0

MP-48 (7/20/04)	14.5'
BETX/MTBE	(ug/kg)
BENZENE	2.1
ETHYLBENZENE	1.3 J
TOLUENE	3.7 J
TOTAL XYLENES	4.2 J
MTBE	<2.2
TOTAL BETX	11.3
METALs	(mg/kg)
LEAD	15.4

HMW-41 (8/4/04)	10.0'–12.0'	DUP-03
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	3.8	2.5
ETHYLBENZENE	3.4 J	3.2 J
TOLUENE	4.3 J	4.3 J
TOTAL XYLENES	8.9	6.7
MTBE	<3.2	<2.7
TOTAL BETX	20.4	16.7
METALs	(mg/kg)	(mg/kg)
LEAD	25.1	21.5

VMP-15 (9/2/04)	8.0'
BETX/MTBE	(ug/kg)
BENZENE	22,300
ETHYLBENZENE	51,000
TOLUENE	76,400
TOTAL XYLENES	199,000
MTBE	<2,370
TOTAL BETX	348,700

HMW-43 (8/4/04)	7.0'–8.0'
BETX/MTBE	(ug/kg)
BENZENE	1.4
ETHYLBENZENE	1.5 J
TOLUENE	2.1 J
TOTAL XYLENES	5.5 J
MTBE	<2.5
TOTAL BETX	10.5
METALs	(mg/kg)
LEAD	16.3

LEGEND:

- • MONITORING PROBE/WELL LOCATION
- ND NON DETECT ABOVE REPORTING LIMITS
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006G
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM
THE CLAY ABOVE THE N. OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4–4

HMW-49 (8/24/04)	15.0'–17.0'
BETX/MTBE	(ug/kg)
BENZENE	0.6 J
ETHYLBENZENE	<5.2
TOLUENE	<5.2
TOTAL XYLENES	<5.2
MTBE	<2.1
TOTAL BETX	0.6
METALs	(mg/kg)
LEAD	21.1

HMW-47 (8/2/04)	24.0'–26.0'	DUP-01
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	415	<35.3
ETHYLBENZENE	150 J	<177
TOLUENE	198	<177
TOTAL XYLENES	353	<177
MTBE	<74.3	<70.7
TOTAL BETX	1,116	ND
METALs	(mg/kg)	(mg/kg)
LEAD	16.7	14.6

HMW-45 (8/4/04)	22.0'–24.0'
BETX/MTBE	(ug/kg)
BENZENE	1,370
ETHYLBENZENE	<210
TOLUENE	42 J
TOTAL XYLENES	58 J
MTBE	<84.0
TOTAL BETX	1,470
METALs	(mg/kg)
LEAD	18.8
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-46 (8/2/04)	22.0'–24.0'
BETX/MTBE	(ug/kg)
BENZENE	7,760
ETHYLBENZENE	2,900
TOLUENE	300 J
TOTAL XYLENES	1,320
MTBE	<479
TOTAL BETX	12,280
METALs	(mg/kg)
LEAD	12.6

HMW-48 (8/2/04)	14.0'–16.0'
BETX/MTBE	(ug/kg)
BENZENE	9,580
ETHYLBENZENE	9,430
TOLUENE	380 J
TOTAL XYLENES	23,540 J
MTBE	<478
TOTAL BETX	42,930
METALs	(mg/kg)
LEAD	17.9
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-38 (8/3/04)	26.0'–28.0'
BETX/MTBE	(ug/kg)
BENZENE	11,900
ETHYLBENZENE	16,800
TOLUENE	420 J
TOTAL XYLENES	47,590
MTBE	<537
TOTAL BETX	76,710
METALs	(mg/kg)
LEAD	15
SVOCs	(mg/kg)
TOTAL SVOCs	1.395

MP-29 (7/12/04)	13.0'
BETX/MTBE	(ug/kg)
BENZENE	9.7
ETHYLBENZENE	3 J
TOLUENE	5 J
TOTAL XYLENES	10.6 J
MTBE	<2.4
TOTAL BETX	28.3
METALs	(mg/kg)
LEAD	23
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-39 (8/30/04)	30.0'
BETX/MTBE	(ug/kg)
BENZENE	1.8
ETHYLBENZENE	<8.0
TOLUENE	2.2 J
TOTAL XYLENES	3.8 J
MTBE	<3.2
TOTAL BETX	7.8
METALs	(mg/kg)
LEAD	15.8

MP-47 (7/13/04)	17.0'
BETX/MTBE	(ug/kg)
BENZENE	3.7
ETHYLBENZENE	1.6 J
TOLUENE	5.8 J
TOTAL XYLENES	7.4
MTBE	<2.6
TOTAL BETX	18.5
METALs	(mg/kg)
LEAD	15.1

MP-31 (7/20/04)	19.0'
BETX/MTBE	(ug/kg)
BENZENE	1.8
ETHYLBENZENE	<5.8
TOLUENE	2.8 J
TOTAL XYLENES	2.6 J
MTBE	<2.3
TOTAL BETX	7.2
METALs	(mg/kg)
LEAD	14.8
SVOCs	(mg/kg)
TOTAL SVOCs	ND

MP-55 (7/16/04)	17.5'
BETX/MTBE	(ug/kg)
BENZENE	2,620
ETHYLBENZENE	2,940
TOLUENE	7,170
TOTAL XYLENES	13,200
MTBE	<112
TOTAL BETX	25,930
METALs	(mg/kg)
LEAD	17

HMW-44 (8/5/04)	16.0'–18.0'
BETX/MTBE	(ug/kg)
BENZENE	35,400
ETHYLBENZENE	25,300
TOLUENE	86,900
TOTAL XYLENES	104,500
MTBE	<554
TOTAL BETX	252,100
METALs	(mg/kg)
LEAD	22.1
SVOCs	(mg/kg)
TOTAL SVOCs	1.562

HMW-43 (8/23/04)	22.0'–24.0'	DUP-02
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	15,200	465
ETHYLBENZENE	16,600	12,100
TOLUENE	31,200	7,390
TOTAL XYLENES	56,800	56,000
MTBE	<201	<227
TOTAL BETX	119,800	75,955
METALs	(mg/kg)	(mg/kg)
LEAD	13.7	7.98

LEGEND:

- • MONITORING PROBE/WELL LOCATION
- ND NON DETECT ABOVE REPORTING LIMITS
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9-22-04
SCALE	AS SHOWN
CAD NO.	0309514006K
PRJ NO.	15-03095

SOIL ANALYSIS RESULTS FROM
THE CLAY BELOW THE N. OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 4-5

MP-29 (7/12/04)	13.0'
BETX/MTBE	(ug/kg)
BENZENE	9.7
ETHYLBENZENE	3 J
TOLUENE	5 J
TOTAL XYLENES	10.6 J
MTBE	<2.4
TOTAL BETX	28.3
METALs	(mg/kg)
LEAD	23
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-48 (8/2/04)	14.0'–16.0'
BETX/MTBE	(ug/kg)
BENZENE	9,580
ETHYLBENZENE	9,430
TOLUENE	380 J
TOTAL XYLENES	23,540 J
MTBE	<478
TOTAL BETX	42,930
METALs	(mg/kg)
LEAD	17.9
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-45 (8/4/04)	22.0'–24.0'
BETX/MTBE	(ug/kg)
BENZENE	1,370
ETHYLBENZENE	<210
TOLUENE	42 J
TOTAL XYLENES	58 J
MTBE	<84.0
TOTAL BETX	1,470
METALs	(mg/kg)
LEAD	18.8
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-50 (8/24/04)	9.0'–11.0'
BETX/MTBE	(ug/kg)
BENZENE	<1.2
ETHYLBENZENE	<5.8
TOLUENE	<5.8
TOTAL XYLENES	<5.8
MTBE	<2.3
TOTAL BETX	ND
METALs	(mg/kg)
LEAD	12.7

HMW-39 (8/30/04)	6.0'–8.0'	8.0'–10.0'	12.0'–13.0'
BETX/MTBE	(ug/kg)	(ug/kg)	(ug/kg)
BENZENE	1.4 J	0.7 J	0.8 J
ETHYLBENZENE	<7.7	<7.3	<7.5
TOLUENE	1.7 J	1.8 J	<7.5
TOTAL XYLENES	2.7 J	<7.3	<7.5
MTBE	<3.1	<2.9	<3.0
TOTAL BETX	5.8	2.5	0.8
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	30.2	45	10.8

MP-47 (7/13/04)	17.0'
BETX/MTBE	(ug/kg)
BENZENE	3.7
ETHYLBENZENE	1.6 J
TOLUENE	5.8 J
TOTAL XYLENES	7.4
MTBE	<2.6
TOTAL BETX	18.5
METALs	(mg/kg)
LEAD	15.1

MP-55 (7/16/04)	17.5'
BETX/MTBE	(ug/kg)
BENZENE	2,620
ETHYLBENZENE	2,940
TOLUENE	7,170
TOTAL XYLENES	13,200
MTBE	<112
TOTAL BETX	25,930
METALs	(mg/kg)
LEAD	17

MP-53 (7/15/04)	14.0'
BETX/MTBE	(ug/kg)
BENZENE	4
ETHYLBENZENE	3 J
TOLUENE	10
TOTAL XYLENES	9.2
MTBE	<2.3
TOTAL BETX	26.2
METALs	(mg/kg)
LEAD	17.8

HMW-44 (8/5/04)	16.0'–18.0'
BETX/MTBE	(ug/kg)
BENZENE	35,400
ETHYLBENZENE	25,300
TOLUENE	86,900
TOTAL XYLENES	104,500
MTBE	<554
TOTAL BETX	252,100
METALs	(mg/kg)
LEAD	22.1
SVOCs	(mg/kg)
TOTAL SVOCs	1.562

LEGEND:

- • MONITORING PROBE/WELL LOCATION
- ND NON DETECT ABOVE REPORTING LIMITS
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

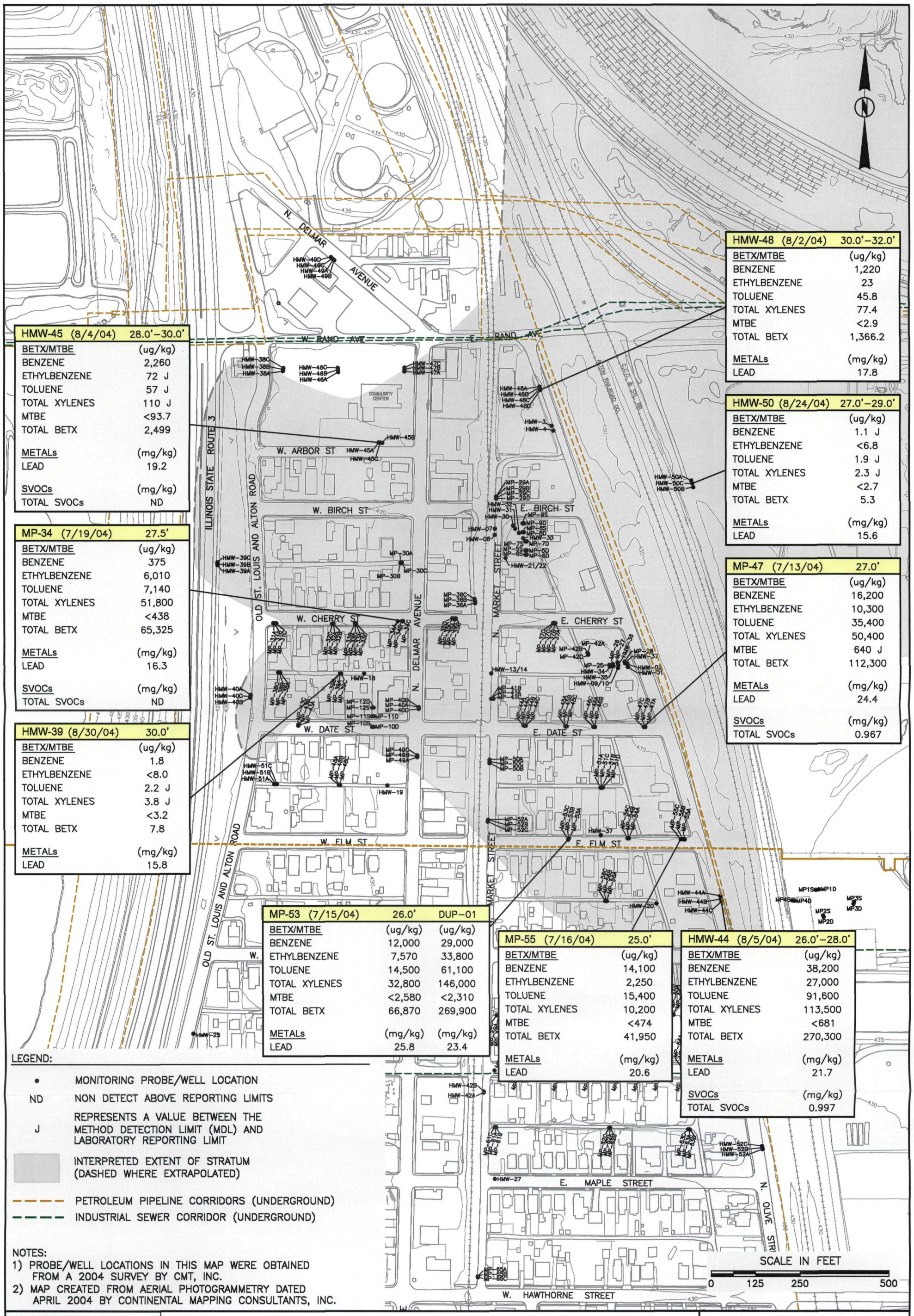
CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006M
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM
THE CLAY ABOVE THE RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4–6



CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006N
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM
THE CLAY BELOW THE RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4–7

HMW-49 (8/24/04)	15.0'–17.0'
BETX/MTBE	(ug/kg)
BENZENE	0.6 J
ETHYLBENZENE	<5.2
TOLUENE	<5.2
TOTAL XYLENES	<5.2
MTBE	<2.1
TOTAL BETX	0.6
METALs	(mg/kg)
LEAD	21.1

HMW-47 (8/2/04)	24.0'–26.0'	DUP–01
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	415	<35.3
ETHYLBENZENE	150 J	<177
TOLUENE	198	<177
TOTAL XYLENES	353	<177
MTBE	<74.3	<70.7
TOTAL BETX	1,116	ND
METALs	(mg/kg)	(mg/kg)
LEAD	16.7	14.6

HMW-48 (8/2/04)	30.0'–32.0'
BETX/MTBE	(ug/kg)
BENZENE	1,220
ETHYLBENZENE	23
TOLUENE	45.8
TOTAL XYLENES	77.4
MTBE	<2.9
TOTAL BETX	1,366.2
METALs	(mg/kg)
LEAD	17.8

HMW-50 (8/24/04)	27.0'–29.0'
BETX/MTBE	(ug/kg)
BENZENE	1.1 J
ETHYLBENZENE	<6.8
TOLUENE	1.9 J
TOTAL XYLENES	2.3 J
MTBE	<2.7
TOTAL BETX	5.3
METALs	(mg/kg)
LEAD	15.6

LEGEND:

- • MONITORING PROBE/WELL LOCATION
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

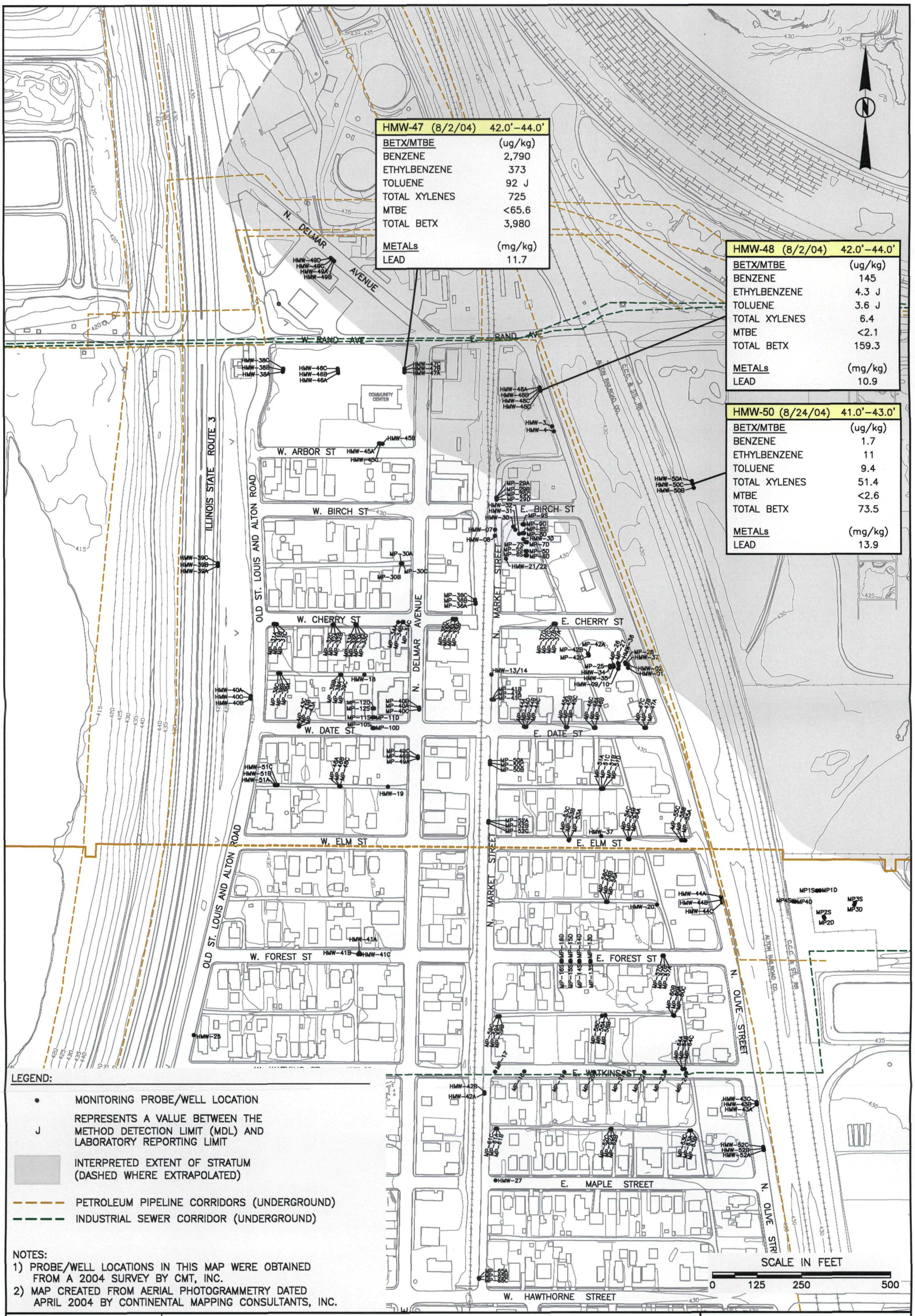
CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006o
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM THE CLAY ABOVE THE EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4–8



CHECK BY	KDC
DRAWN BY	BCP/OS
DATE	9–22–04
SCALE	AS SHOWN
CAD NO.	0309514006P
PRJ NO.	15–03095

SOIL ANALYSIS RESULTS FROM
THE CLAY BELOW THE EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 4–9

HMW-38 (8/3/04)	26.0'–28.0'
BETX/MTBE	(ug/kg)
BENZENE	11,900
ETHYLBENZENE	16,800
TOLUENE	420 J
TOTAL XYLENES	47,590
MTBE	<537
TOTAL BETX	76,710
METALs	(mg/kg)
LEAD	15
SVOCs	(mg/kg)
TOTAL SVOCs	1.395

MP-34 (7/19/04)	27.5'
BETX/MTBE	(ug/kg)
BENZENE	375
ETHYLBENZENE	6,010
TOLUENE	7,140
TOTAL XYLENES	51,800
MTBE	<438
TOTAL BETX	65,325
METALs	(mg/kg)
LEAD	16.3
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-39 (8/30/04)	30.0'
BETX/MTBE	(ug/kg)
BENZENE	1.8
ETHYLBENZENE	<8.0
TOLUENE	2.2 J
TOTAL XYLENES	3.8 J
MTBE	<3.2
TOTAL BETX	7.8
METALs	(mg/kg)
LEAD	15.8

MP-31 (7/20/04)	19.0'
BETX/MTBE	(ug/kg)
BENZENE	1.8
ETHYLBENZENE	<5.8
TOLUENE	2.8 J
TOTAL XYLENES	2.6 J
MTBE	<2.3
TOTAL BETX	7.2
METALs	(mg/kg)
LEAD	14.8
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-40 (8/3/04)	8.0'–10.0'
BETX/MTBE	(ug/kg)
BENZENE	1.9
ETHYLBENZENE	<9
TOLUENE	<9
TOTAL XYLENES	3.4 J
MTBE	<3.6
TOTAL BETX	5.3
METALs	(mg/kg)
LEAD	11.9

HMW-46 (8/2/04)	22.0'–24.0'
BETX/MTBE	(ug/kg)
BENZENE	7,760
ETHYLBENZENE	2,900
TOLUENE	300 J
TOTAL XYLENES	1,320
MTBE	<479
TOTAL BETX	12,280
METALs	(mg/kg)
LEAD	12.6

HMW-45 (8/4/04)	28.0'–30.0'
BETX/MTBE	(ug/kg)
BENZENE	2,260
ETHYLBENZENE	72 J
TOLUENE	57 J
TOTAL XYLENES	110 J
MTBE	<93.7
TOTAL BETX	2,499
METALs	(mg/kg)
LEAD	19.2
SVOCs	(mg/kg)
TOTAL SVOCs	ND

HMW-47 (8/2/04)	42.0'–44.0'
BETX/MTBE	(ug/kg)
BENZENE	2,790
ETHYLBENZENE	373
TOLUENE	92 J
TOTAL XYLENES	725
MTBE	<65.6
TOTAL BETX	3,980
METALs	(mg/kg)
LEAD	11.7

HMW-48 (8/2/04)	42.0'–44.0'
BETX/MTBE	(ug/kg)
BENZENE	145
ETHYLBENZENE	4.3 J
TOLUENE	3.6 J
TOTAL XYLENES	6.4
MTBE	<2.1
TOTAL BETX	159.3
METALs	(mg/kg)
LEAD	10.9

HMW-50 (8/24/04)	41.0'–43.0'
BETX/MTBE	(ug/kg)
BENZENE	1.7
ETHYLBENZENE	11
TOLUENE	9.4
TOTAL XYLENES	51.4
MTBE	<2.6
TOTAL BETX	73.5
METALs	(mg/kg)
LEAD	13.9

MP-47 (7/13/04)	27.0'
BETX/MTBE	(ug/kg)
BENZENE	16,200
ETHYLBENZENE	10,300
TOLUENE	35,400
TOTAL XYLENES	50,400
MTBE	640 J
TOTAL BETX	112,300
METALs	(mg/kg)
LEAD	24.4
SVOCs	(mg/kg)
TOTAL SVOCs	0.967

MP-53 (7/15/04)	26.0'	DUP-01
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	12,000	29,000
ETHYLBENZENE	7,570	33,800
TOLUENE	14,500	61,100
TOTAL XYLENES	32,800	146,000
MTBE	<2,580	<2,310
TOTAL BETX	66,870	269,900
METALs	(mg/kg)	(mg/kg)
LEAD	25.8	23.4

MP-55 (7/16/04)	25.0'
BETX/MTBE	(ug/kg)
BENZENE	14,100
ETHYLBENZENE	2,250
TOLUENE	15,400
TOTAL XYLENES	10,200
MTBE	<474
TOTAL BETX	41,950
METALs	(mg/kg)
LEAD	20.6

HMW-44 (8/5/04)	26.0'–28.0'
BETX/MTBE	(ug/kg)
BENZENE	38,200
ETHYLBENZENE	27,000
TOLUENE	91,600
TOTAL XYLENES	113,500
MTBE	<681
TOTAL BETX	270,300
METALs	(mg/kg)
LEAD	21.7
SVOCs	(mg/kg)
TOTAL SVOCs	0.997

HMW-43 (8/23/04)	22.0'–24.0'	DUP-02
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	15,200	465
ETHYLBENZENE	16,600	12,100
TOLUENE	31,200	7,390
TOTAL XYLENES	56,800	56,000
MTBE	<201	<227
TOTAL BETX	119,800	75,955
METALs	(mg/kg)	(mg/kg)
LEAD	13.7	7.98

HMW-52 (8/25/04)	10.0'–12.0'
BETX/MTBE	(ug/kg)
BENZENE	0.8 J
ETHYLBENZENE	<7.1
TOLUENE	1.8 J
TOTAL XYLENES	4.9 J
MTBE	<2.8
TOTAL BETX	7.5
METALs	(mg/kg)
LEAD	11.5

HMW-42 (8/4/04)	14.0'–16.0'
BETX/MTBE	(ug/kg)
BENZENE	1.9
ETHYLBENZENE	2.5 J
TOLUENE	4.5 J
TOTAL XYLENES	9.8
MTBE	<3.2
TOTAL BETX	18.7
METALs	(mg/kg)
LEAD	22.6

MP-65 (8/18/04)	8.0'–10.0'
BETX/MTBE	(ug/kg)
BENZENE	0.8 J
ETHYLBENZENE	1.6 J
TOLUENE	2.1 J
TOTAL XYLENES	5.9 J
MTBE	<2.4
TOTAL BETX	10.4
METALs	(mg/kg)
LEAD	21.5

MP-66 (8/20/04)	6.0'–8.0'
BETX/MTBE	(ug/kg)
BENZENE	<1.3
ETHYLBENZENE	<6.3
TOLUENE	1.7 J
TOTAL XYLENES	4 J
MTBE	<2.5
TOTAL BETX	5.7
METALs	(mg/kg)
LEAD	18.7

MP-67 (8/19/04)	6.0'–8.0'	14.0'–16.0'
BETX/MTBE	(ug/kg)	(ug/kg)
BENZENE	0.9 J	1.1 J
ETHYLBENZENE	1.6 J	<6.9
TOLUENE	2.4 J	2.2 J
TOTAL XYLENES	5.9 J	<6.9
MTBE	<2.8	<2.8
TOTAL BETX	10.8	3.3
METALs	(mg/kg)	(mg/kg)
LEAD	8.19	14.1

LEGEND:

- ⊙ MONITORING PROBE/WELL LOCATION
- ND NON DETECT ABOVE REPORTING LIMITS
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

DESIGN BY:	
CHECKED BY:	KDC
DRAWN BY:	BCP/OS
DATE:	9-23-04
SCALE:	AS SHOWN
CAD NO.:	0309514006R
PROJECT NO.:	15-03095

Clayton GROUP SERVICES

SOIL ANALYSIS RESULTS FROM
THE CLAY ABOVE THE MAIN SAND

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

FIGURE
4-10

HMW-49 (8/24/04)	7.0'–9.0'	15.0'–17.0'
BETX	(ug/kg)	(ug/kg)
TOTAL BETX	1.7	0.6
METALs	(mg/kg)	(mg/kg)
LEAD	15.0	21.1

HMW-46 (8/2/04)	8.0'–10.0'	12.0'–14.0'	22.0'–24.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	2,948	7,115	12,280
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	12.8	13.6	12.6
SVOCs		(mg/kg)	
TOTAL SVOCs	--	ND	--

HMW-47 (8/2/04)	10.0'–12.0'	14.0'–16.0'	24.0'–26.0'	24.0'–26.0' DUP-01	42.0'–44.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	8.1	11.6	1,116	<566.3	3,980
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	14.0	20.2	16.7	14.6	11.7
SVOCs		(mg/kg)			
TOTAL SVOCs	--	ND	--	--	--

HMW-38 (8/3/04)	6.0'–8.0'	12.0'–14.0'	26.0'–28.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	237	270	76,710
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	16	15	15
SVOCs			(mg/kg)
TOTAL SVOCs	--	--	1.395

HMW-48 (8/2/04)	6.0'–8.0'	12.0'–14.0'	14.0'–16.0'	22.0'–24.0'	30.0'–32.0'	42.0'–44.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	443,670	163,520	42,930	163,660	1,366.2	159.3
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	14.6	13.5	17.9	12.4	17.8	10.9
SVOCs			(mg/kg)	(mg/kg)		
TOTAL SVOCs	--	--	ND	4.6	--	--

HMW-45 (8/4/04)	10.0'–12.0'	12.0'–14.0'	22.0'–24.0'	28.0'–30.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	235	47.6	1,470	2,499
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	20.4	14.4	18.8	19.2
SVOCs			(mg/kg)	(mg/kg)
TOTAL SVOCs	--	--	ND	ND

HMW-50 (8/24/04)	9.0'–11.0'	27.0'–29.0'	41.0'–43.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	<18.6	5.3	73.5
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	12.7	15.6	13.9

HMW-39 (8/30/04)	6.0'–8.0'	8.0'–10.0'	12.0'–13.0'	14.0'–15.0'	14.0'–15.0' DUP-01	30.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	5.8	2.5	0.8	17.6	15.0	7.8
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	30.2	45.0	10.8	8.37	9.49	15.8

MP-29 (7/12/04)	7.5'	13.0'	16.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	3.9	28.3	31.8
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	16.7	23.0	16.4
SVOCs		(mg/kg)	
TOTAL SVOCs	--	ND	--

MP-31 (7/20/04)	12.0'	12.0' DUP-02	19.0'	24.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	33.6	30.2	7.2	17.7
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	13.5	11.5	14.8	14.8
SVOCs			(mg/kg)	
TOTAL SVOCs	--	--	ND	--

MP-47 (7/13/04)	7.0'	10.0'	17.0'	20.0'	27.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	11.4	12.6	15.1	1,939,550	112,300
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	16.1	13.3	15.1	17.3	24.4
SVOCs		(mg/kg)		(mg/kg)	(mg/kg)
TOTAL SVOCs	--	ND	--	1.95	0.967

HMW-40 (8/3/04)	8.0'–10.0'	12.0'–14.0'	22.0'–24.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	5.3	25.2	19.1
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	11.9	9.33	4.86

MP-55 (7/16/04)	12.0'	17.5'	20.0'	25.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	1,135	25,930	846,600	41,950
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	13.9	17.0	13.2	20.6
SVOCs	(mg/kg)		(mg/kg)	
TOTAL SVOCs	ND	--	9.4	--

MP-34 (7/19/04)	13.5'	19.5'	27.5'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	8.3	13.6	65,325
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	17.0	16.3	16.3
SVOCs			(mg/kg)
TOTAL SVOCs	--	--	ND

MP-44 (8/5/04)	6.0'–8.0'	10.0'–12.0'	10.0'–12.0' DUP-02	16.0'–18.0'	20.0'–22.0'	26.0'–28.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	387,100	581,900	689,700	252,100	2,904,000	270,300
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	20.0	13.8	11.4	22.1	23.7	21.7
SVOCs				(mg/kg)	(mg/kg)	(mg/kg)
TOTAL SVOCs	--	--	--	1.562	52.7	0.997

HMW-51 (8/3/04)	8.0'–10.0'	10.0'–12.0'	18.0'–20.0'	18.0'–20.0' DUP-02
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	20.0	15.2	26.1	25.5
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	12.8	11.2	4.78	4.6
SVOCs		(mg/kg)		
TOTAL SVOCs	--	ND	--	--

MP-53 (7/15/04)	14.0'	19.5'	26.0'	26.0' DUP-01
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	26.2	431,090	66,870	269,900
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	17.8	29.7	25.8	23.4

MP-48 (7/20/04)	14.5'	24.0'	24.0' DUP-03
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	11.3	710,600	687,000
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	15.4	8.44	7.29

HMW-43 (8/4/04)	7.0'–8.0'	12.0'–14.0'	22.0'–24.0'	22.0'–24.0' DUP-04
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	10.5	230,260	119,800	75,955
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	16.3	7.15	13.7	7.98

HMW-41 (8/4/04)	10.0'–12.0'	10.0'–12.0' DUP-03	15.0'–16.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	20.4	16.7	50.2
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	25.1	21.5	10.6

HMW-52 (8/25/04)	10.0'–12.0'	14.0'–16.0'
BETX	(ug/kg)	(ug/kg)
TOTAL BETX	7.5	19.5
METALs	(mg/kg)	(mg/kg)
LEAD	11.5	10.1

HMW-42 (8/4/04)	14.0'–16.0'	23.0'–24.0'
BETX	(ug/kg)	(ug/kg)
TOTAL BETX	18.7	52.5
METALs	(mg/kg)	(mg/kg)
LEAD	22.6	6.84

MP-67 (8/19/04)	6.0'–8.0'	14.0'–16.0'	20.0'–22.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	10.8	3.3	12.8
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	8.19	14.1	6.82

MP-65 (8/18/04)	8.0'–10.0'	10.0'–12.0'	10.0'–12.0' DUP-01	20.0'–22.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	10.4	20.0	2.1	25.5
METALs	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	21.5	7.77	9.16	6.95

MP-66 (8/20/04)	6.0'–8.0'	10.0'–12.0'	20.0'–22.0'
BETX	(ug/kg)	(ug/kg)	(ug/kg)
TOTAL BETX	5.7	33.5	10.3
METALs	(mg/kg)	(mg/kg)	(mg/kg)
LEAD	18.7	14.8	3.1 J

LEGEND:

- ⊙ MONITORING PROBE/WELL LOCATION
- ND NON DETECT ABOVE REPORTING LIMITS
- -- SAMPLE NOT ANALYZED
- J REPRESENTS A VALUE BETWEEN THE METHOD DETECTION LIMIT (MDL) AND LABORATORY REPORTING LIMIT
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:
1) PROBE/WELL LOCATIONS IN THIS MAP WERE OBTAINED FROM A 2004 SURVEY BY CMT, INC.
2) MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 125 250 500

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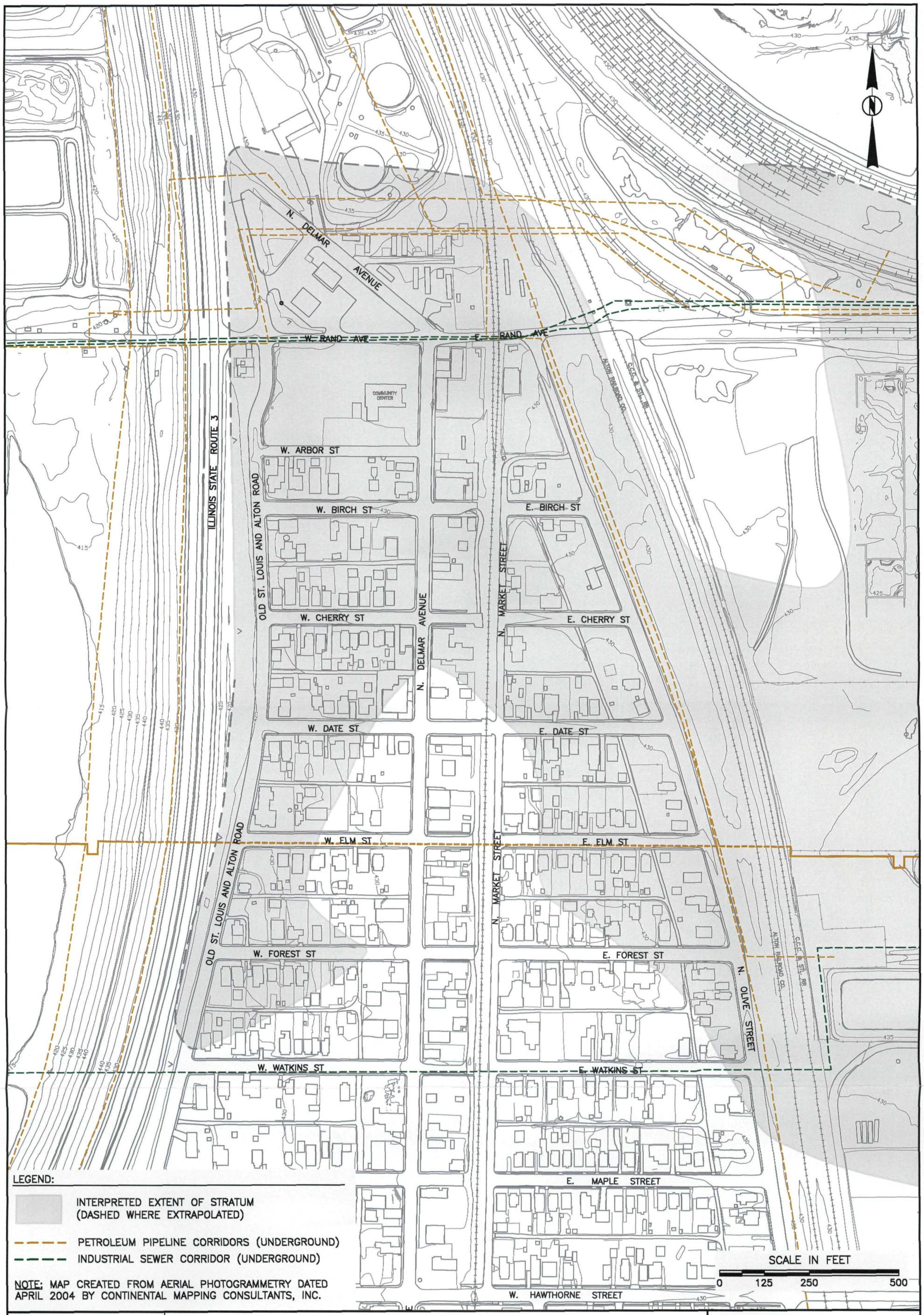
PRJ NO.	15-03095

SOIL ANALYSIS RESULTS IN PROFILE

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 4-11



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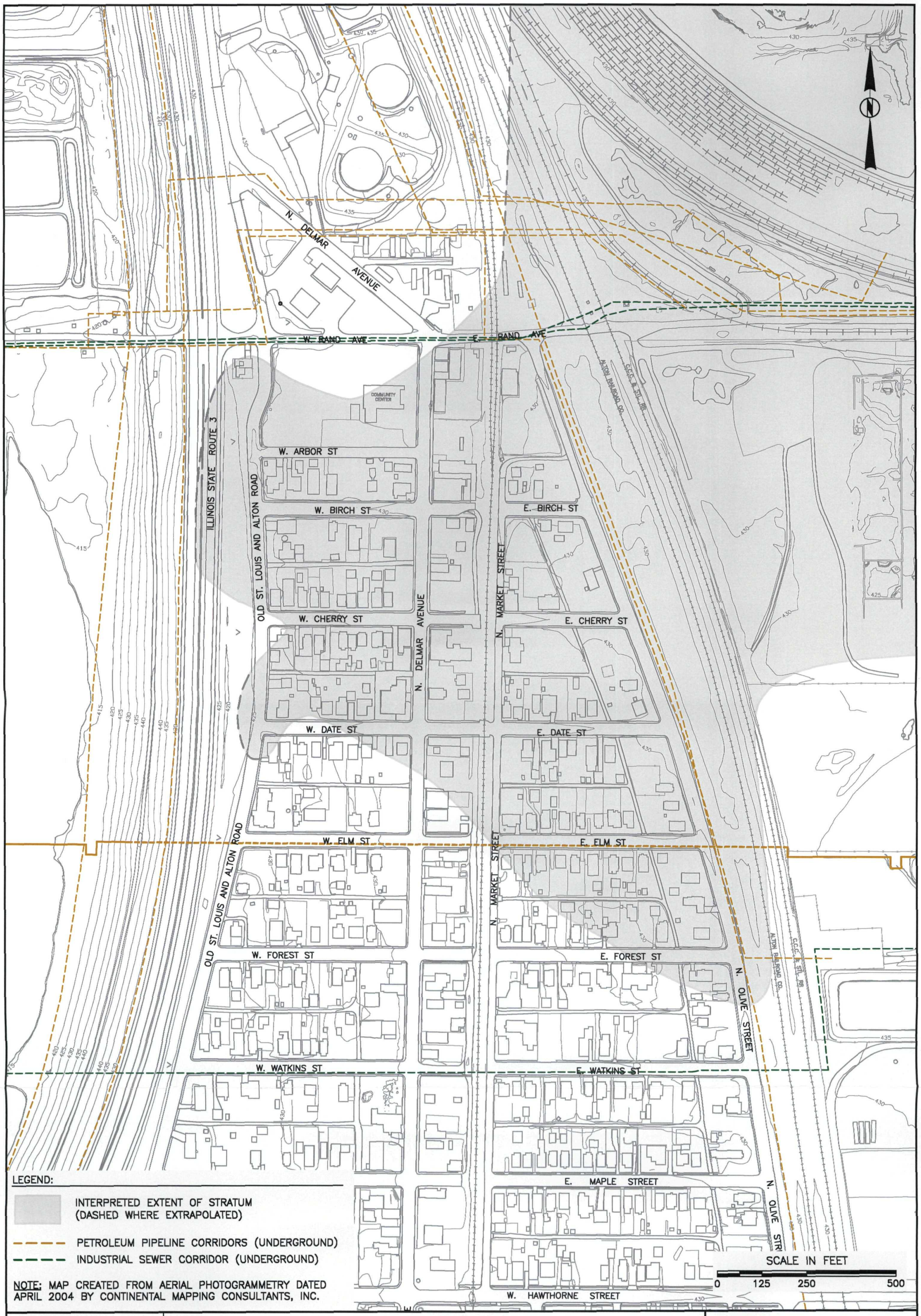
DRAWN BY	BCP/OS
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309514006W-1
PRJ NO.	15-03095

EXTENTS OF THE N. OLIVE STRATUM
OCTOBER 2004

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5-1



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DATE	10-15-04
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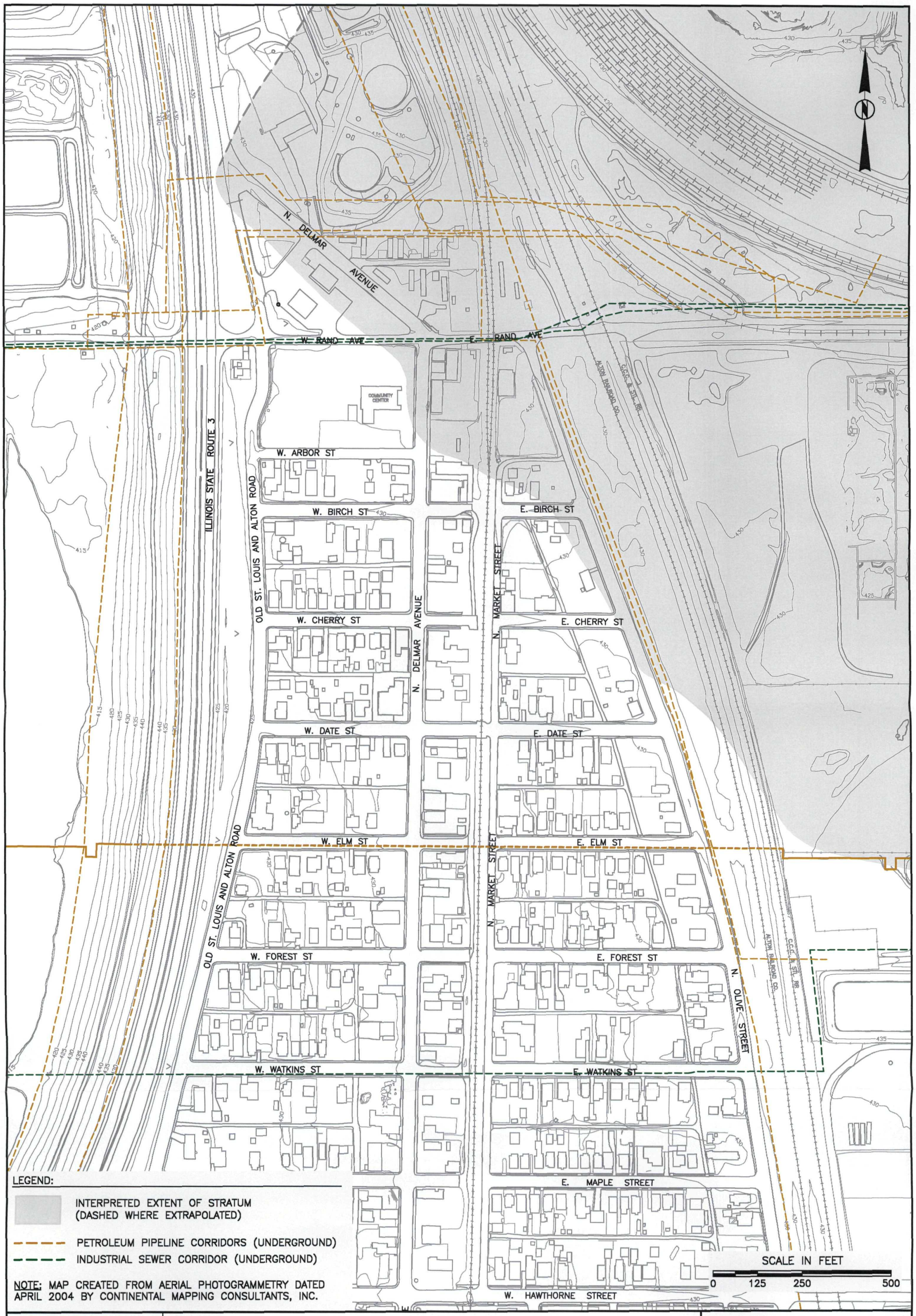
CAD NO.	0309514006w-2
PRJ NO.	15-03095

EXTENTS OF THE RAND STRATUM
OCTOBER 2004

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-2



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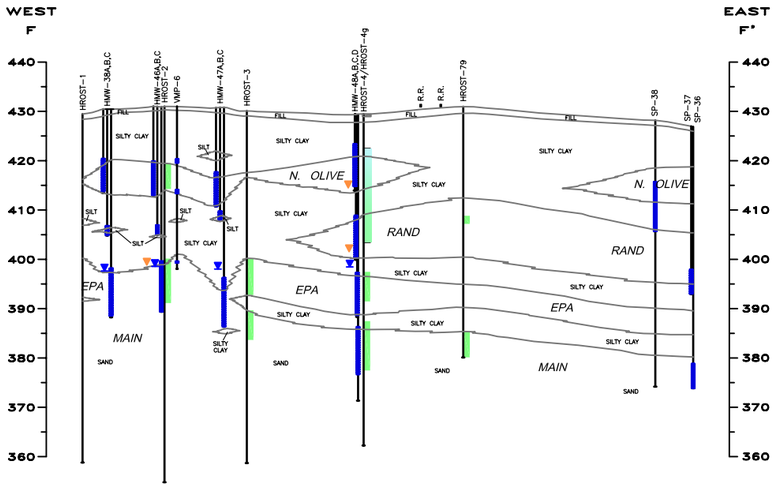
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309514006w-3
PRJ NO.	15-03095

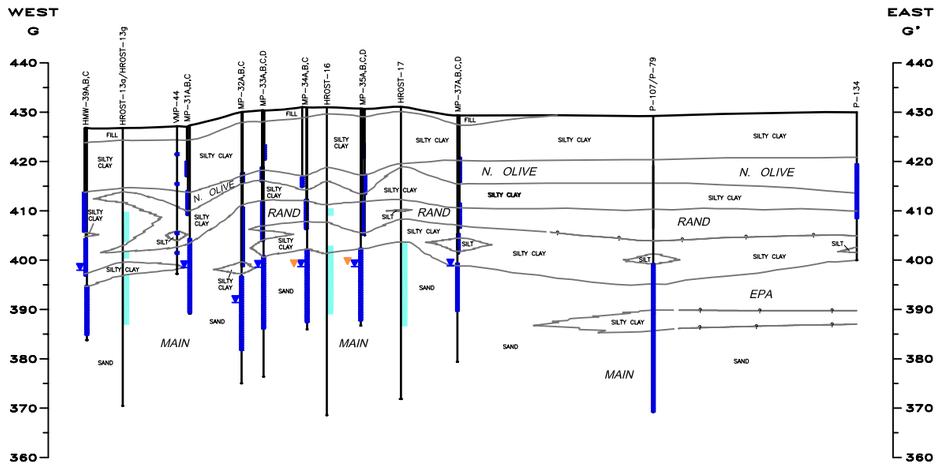
EXTENTS OF THE EPA STRATUM
OCTOBER 2004

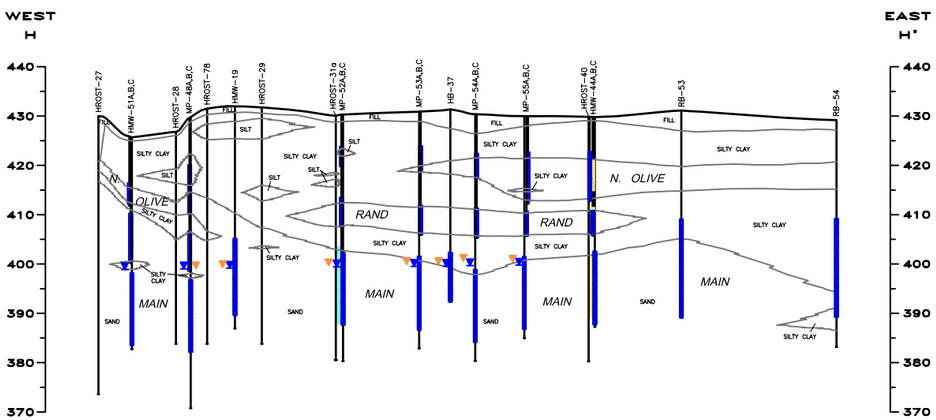
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

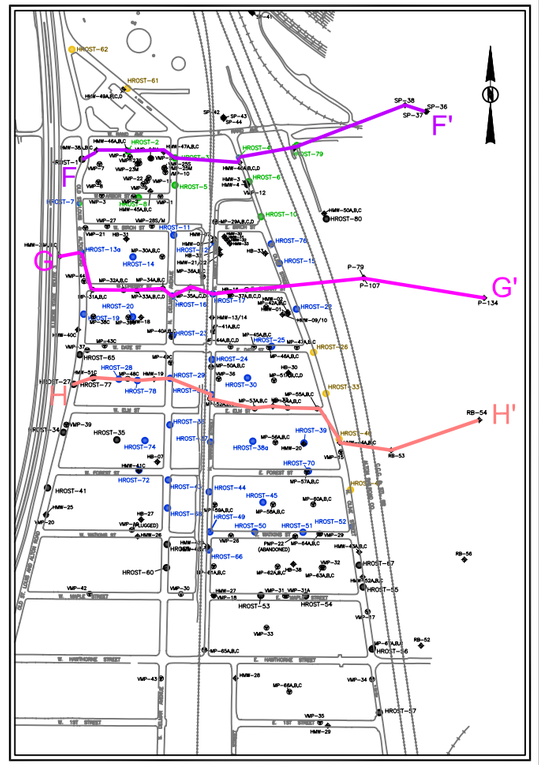
Clayton® GROUP SERVICES

FIGURE 5-3









REFERENCE MAP

SCALE IN FEET

0 150 300 600

VERTICAL SCALE: 1' = 20'

LEGEND

- YELLOW ROST RESPONSE
- GREEN ROST RESPONSE
- BLUE ROST RESPONSE
- GROUNDWATER ELEVATION (MEASURED SEPTEMBER 20–22, 2004)
- FPH ELEVATION (IF PRESENT) (MEASURED SEPTEMBER 20–22, 2004)

NOTES:

1. CROSS SECTIONS ARE BASED ON BEST PROFESSIONAL JUDGMENT USING DATA AVAILABLE AT THE TIME OF CONSTRUCTION. THE GEOLOGY PRESENTED IN THE CROSS SECTIONS WAS GENERALIZED TO ILLUSTRATE THE MAJOR LITHOLOGIC UNITS. THE THICKNESS AND EXTENT OF THE LITHOLOGIC UNITS ARE APPROXIMATED AND GEOLOGIC CONTACTS BETWEEN LOCATIONS ARE INFERRED.
2. HROST–SERIES BORINGS WERE COMPLETED, DURING JANUARY AND FEBRUARY 2004, BY FUGRO GEOSCIENCES, INC. USING CPT AND ROST™ METHODOLOGY. HROST–SERIES BORINGS, APPENDED WITH A "g", WERE COMPLETED ADJACENT TO THE ORIGINAL HROST–SERIES BORINGS, DURING JANUARY AND FEBRUARY 2004, BY PHILIP ENVIRONMENTAL SERVICES CORPORATION USING GEOPROBE® METHODOLOGY. HMW–25 AND HIGHER SERIES BORINGS AND MP SERIES WERE COMPLETED DURING JULY AND AUGUST 2004, BY PHILIP ENVIRONMENTAL SERVICES CORPORATION USING GEOPROBE® AND HOLLOW STEM AUGER METHODOLOGY. VMP SERIES BORINGS WERE COMPLETED BY ENSR CORPORATION. REMAINING BORINGS WERE COMPLETED BY OTHERS.
3. GROUND SURFACE ELEVATIONS FOR HROST SERIES LOCATIONS ARE APPROXIMATE AND WERE ESTIMATED FROM AVAILABLE NEARBY GROUND SURFACE ELEVATION SURVEY DATA AT VILLAGE MONITORING WELLS AND SELECTED SANITARY SEWER MANHOLES. GROUND SURFACE ELEVATIONS FOR HMW–25 AND HIGHER SERIES BORINGS AND MP SERIES WERE DETERMINED BY A 2004 SURVEY BY CMT, INC.
4. VERTICAL COLOR BARS ADJACENT TO HROST–SERIES BORINGS REPRESENT THE LOCATION AND VERTICAL EXTENT OF THE PETROLEUM HYDROCARBONS DETECTED BY THE ROST™ TECHNOLOGY. THE PRESENCE OF A COLOR BAR IS NOT A REPRESENTATION OF LIGHT NON–AQUEOUS PHASE LIQUID THICKNESS.
5. TWO OR MORE OF THE INDIVIDUAL HYDROCARBON COLORS REPRESENT COMMINGLED PETROLEUM HYDROCARBONS.
6. NO APPARENT PETROLEUM HYDROCARBONS WERE DETECTED AT THOSE HROST–SERIES BORINGS WITHOUT A VERTICAL COLOR BAR.
7. MAIN SAND, EPA STRATUM, RAND STRATUM AND NORTH OLIVE STRATUM ARE NAMES DEVELOPED FOR LOCAL HYDROSTRATIGRAPHIC UNITS.
8. WELLS MAY BE PROJECTED ONTO THE CROSS SECTION.

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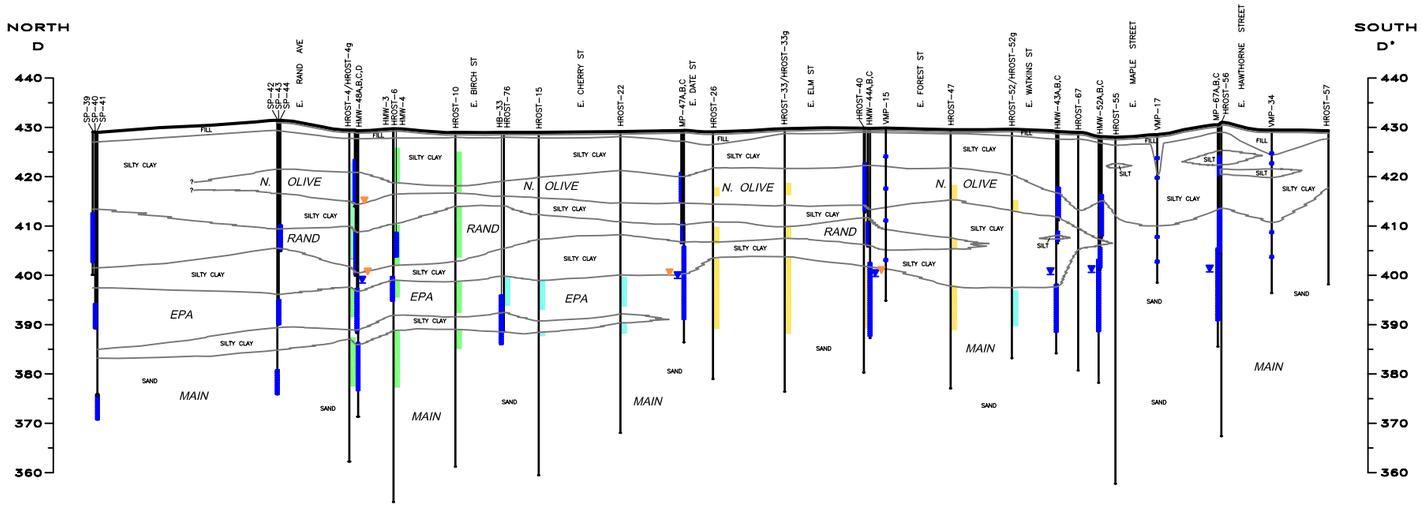
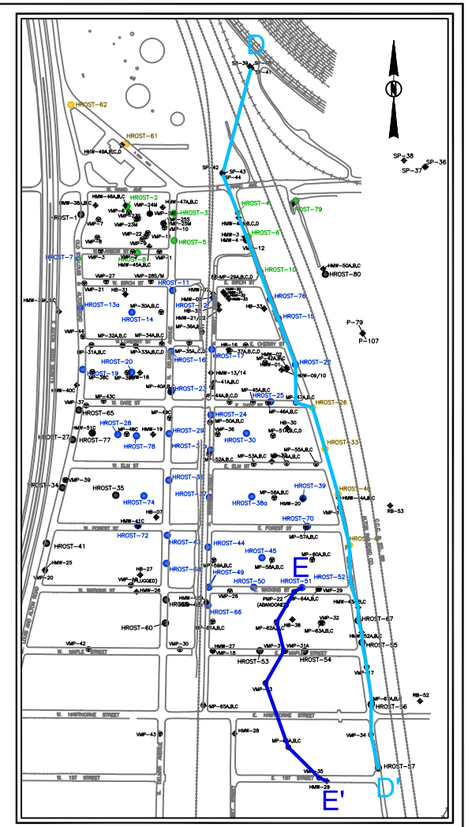
CROSS SECTIONS F–F', G–G', AND H–H'

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5–7





REFERENCE MAP

LEGEND

- YELLOW ROST RESPONSE
- GREEN ROST RESPONSE
- BLUE ROST RESPONSE
- GROUNDWATER ELEVATION (MEASURED SEPTEMBER 20–22, 2004)
- FPH ELEVATION (IF PRESENT) (MEASURED SEPTEMBER 20–22, 2004)

NOTES:

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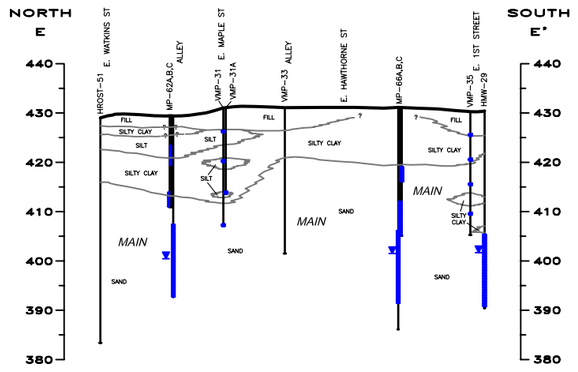
8. WELLS MAY BE PROJECTED ONTO THE CROSS SECTION.



SCALE IN FEET

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VERTICAL SCALE: 1' = 20'

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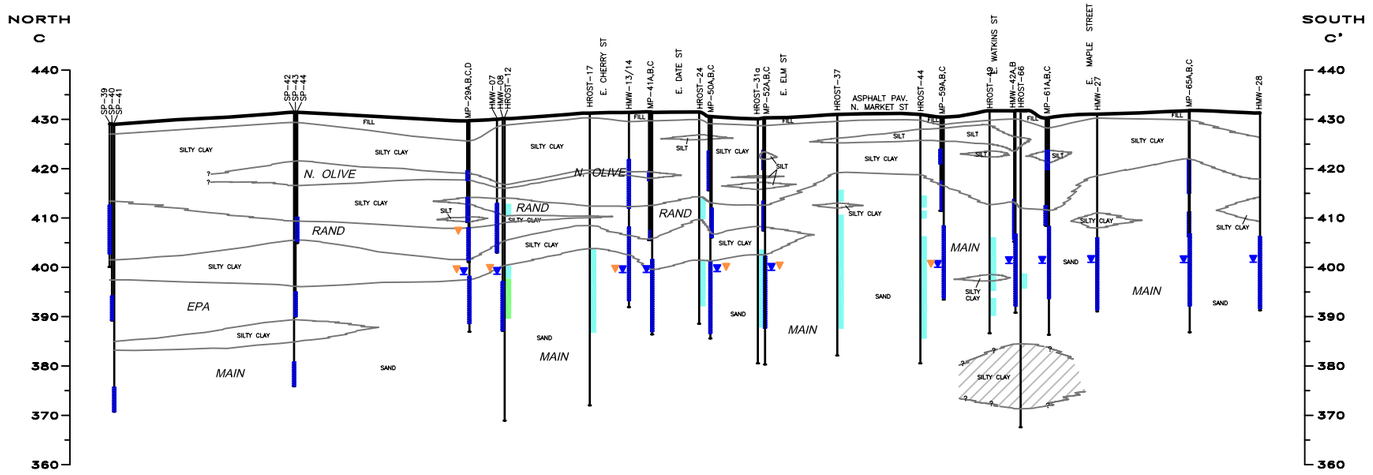
PRJ NO.	15–03095.14

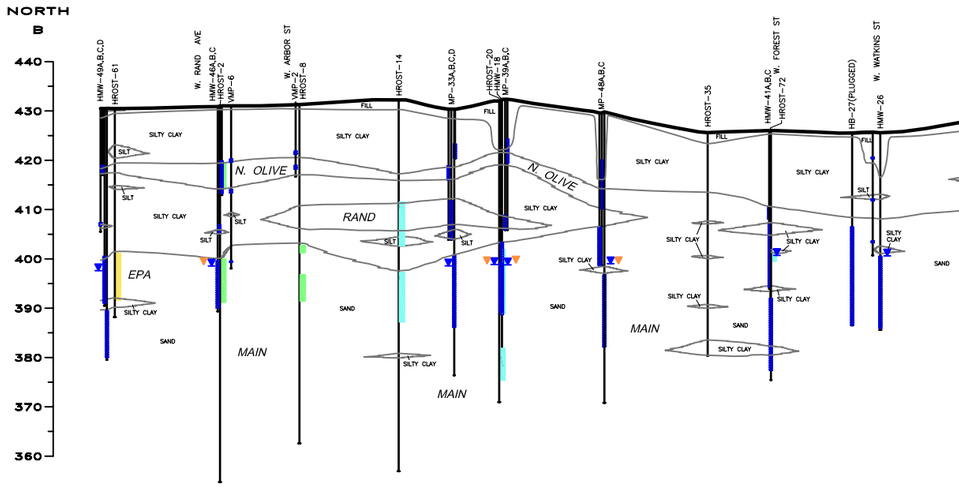
CROSS SECTIONS D–D', E–E'

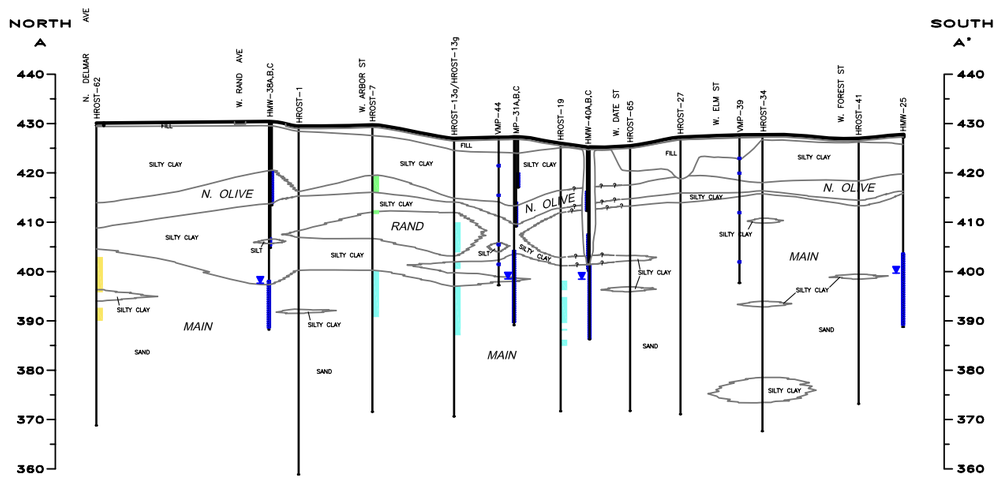
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

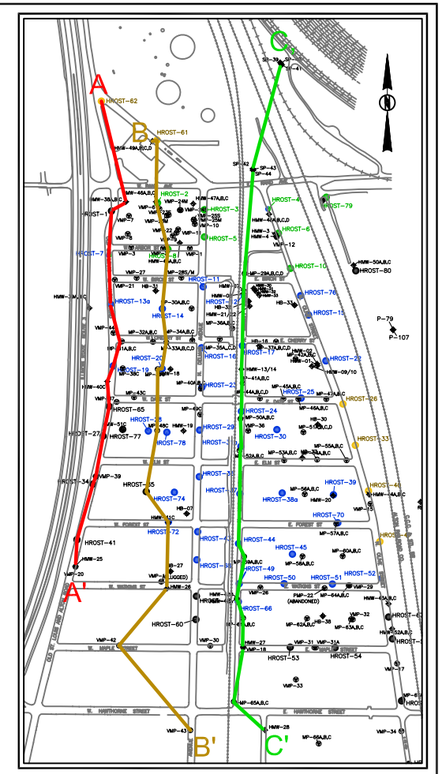
Clayton GROUP SERVICES

FIGURE 5–6









LEGEND

- YELLOW ROST RESPONSE
- GREEN ROST RESPONSE
- BLUE ROST RESPONSE
- GROUNDWATER ELEVATION (MEASURED SEPTEMBER 20–22, 2004)
- FPH ELEVATION (IF PRESENT) (MEASURED SEPTEMBER 20–22, 2004)

SCALE IN FEET

0 150 300 600

VERTICAL SCALE: 1" = 20'

NOTES:

1. CROSS SECTIONS ARE BASED ON BEST PROFESSIONAL JUDGMENT USING DATA AVAILABLE AT THE TIME OF CONSTRUCTION. THE GEOLOGY PRESENTED IN THE CROSS SECTIONS WAS GENERALIZED TO ILLUSTRATE THE MAJOR LITHOLOGIC UNITS. THE THICKNESS AND EXTENT OF THE LITHOLOGIC UNITS ARE APPROXIMATED AND GEOLOGIC CONTACTS BETWEEN LOCATIONS ARE INFERRED.
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8. WELLS MAY BE PROJECTED ONTO THE CROSS SECTION.

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DATE	10–29–04
SCALE	AS SHOWN
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PRJ NO.	15–03095.14

CROSS SECTIONS A–A', B–B', AND C–C'

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5–5

LEGEND:

- A—A' CROSS SECTION REFERENCE LINE
- CPT/ROST™ INVESTIGATION LOCATION NO APPARENT PETROLEUM HYDROCARBON (BLACK)
- CPT/ROST™ INVESTIGATION LOCATION BLUE ROST RESPONSE
- CPT/ROST™ INVESTIGATION LOCATION GREEN ROST RESPONSE
- CPT/ROST™ INVESTIGATION LOCATION YELLOW ROST RESPONSE
- SENTINEL MONITORING WELLS
- EXISTING MONITORING WELL (HB, HMW, P, SP, RB)
- RECOVERY WELL (RW)
- PRODUCTION WELL (P)
- PUBLIC WATER SUPPLY WELL (WSW)
- EXISTING PERMANENT SOIL VAPOR SAMPLING POINTS (MP, VP, VMP)
- S/M/D SHALLOW/MEDIUM/DEEP
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

SCALE IN FEET
0 100 200 400

DESIGN BY:	
CHECKED BY:	
DRAWN BY:	BCP
DATE:	10-29-04
SCALE:	AS SHOWN
CAD NO.:	0309514006D
PROJECT NO.:	15-03095.14

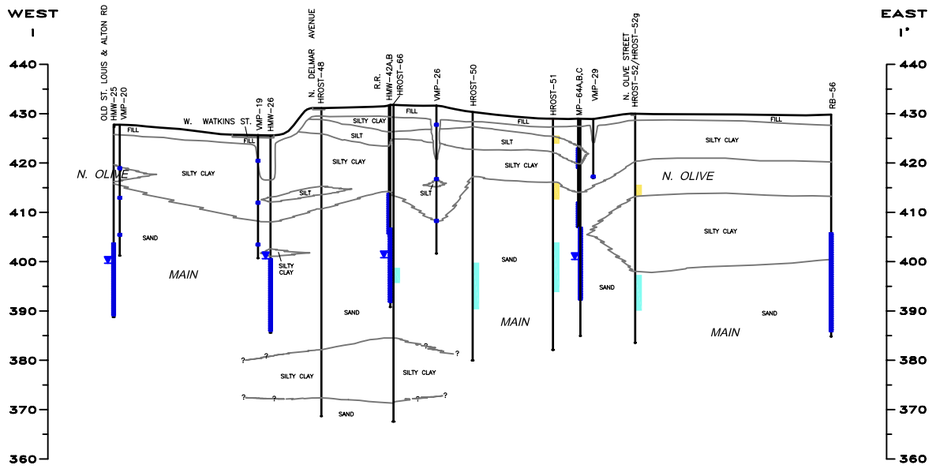
Clayton GROUP SERVICES

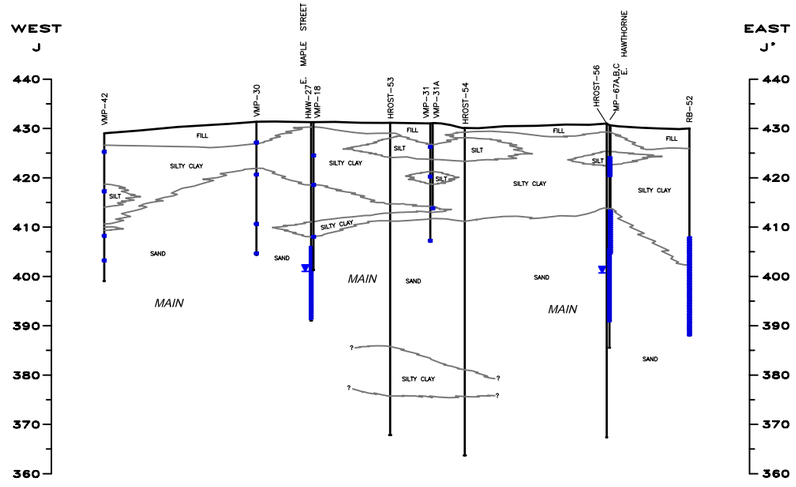
CROSS SECTION REFERENCE MAP

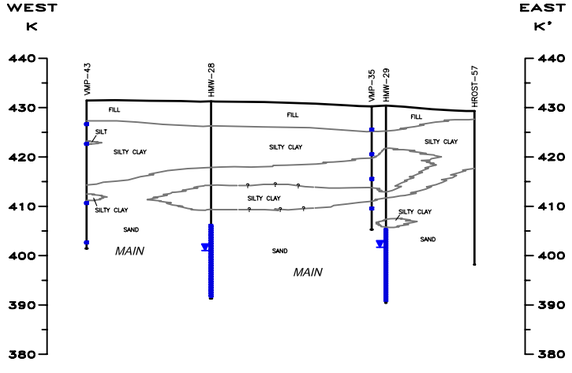
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

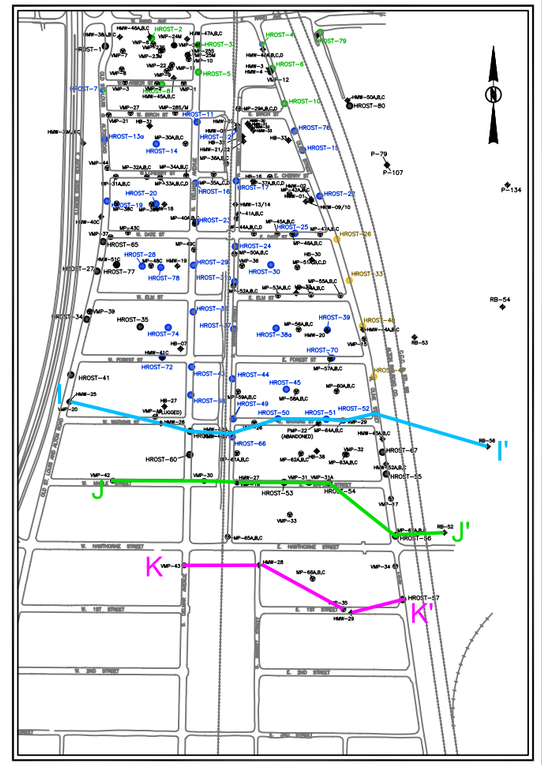
FIGURE

5-4









REFERENCE MAP

LEGEND

- YELLOW ROST RESPONSE
- GREEN ROST RESPONSE
- BLUE ROST RESPONSE
- GROUNDWATER ELEVATION (MEASURED SEPTEMBER 20–22, 2004)
- FPH ELEVATION (IF PRESENT) (MEASURED SEPTEMBER 20–22, 2004)

NOTES:

1. CROSS SECTIONS ARE BASED ON BEST PROFESSIONAL JUDGMENT USING DATA AVAILABLE AT THE TIME OF CONSTRUCTION. THE GEOLOGY PRESENTED IN THE CROSS SECTIONS WAS GENERALIZED TO ILLUSTRATE THE MAJOR LITHOLOGIC UNITS. THE THICKNESS AND EXTENT OF THE LITHOLOGIC UNITS ARE APPROXIMATED AND GEOLOGIC CONTACTS BETWEEN LOCATIONS ARE INFERRED.
2. HROST–SERIES BORINGS WERE COMPLETED, DURING JANUARY AND FEBRUARY 2004, BY FUGRO GEOSCIENCES, INC. USING CPT AND ROST™ METHODOLOGY. HROST–SERIES BORINGS, APPENDED WITH A "9", WERE COMPLETED ADJACENT TO THE ORIGINAL HROST–SERIES BORINGS, DURING JANUARY AND FEBRUARY 2004, BY PHILIP ENVIRONMENTAL SERVICES CORPORATION USING GEOPROBE® METHODOLOGY. HWW–25 AND HIGHER SERIES BORINGS AND MP SERIES WERE COMPLETED DURING JULY AND AUGUST 2004, BY PHILIP ENVIRONMENTAL SERVICES CORPORATION USING GEOPROBE® AND HOLLOW STEM AUGER METHODOLOGY. VMP SERIES BORINGS WERE COMPLETED BY ENSR CORPORATION. REMAINING BORINGS WERE COMPLETED BY OTHERS.
3. GROUND SURFACE ELEVATIONS FOR HROST SERIES LOCATIONS ARE APPROXIMATE AND WERE ESTIMATED FROM AVAILABLE NEARBY GROUND SURFACE ELEVATION SURVEY DATA AT VILLAGE MONITORING WELLS AND SELECTED SANITARY SEWER MANHOLES. GROUND SURFACE ELEVATIONS FOR HWW–25 AND HIGHER SERIES BORINGS AND MP SERIES WERE DETERMINED BY A 2004 SURVEY BY CMT, INC.
4. VERTICAL COLOR BARS ADJACENT TO HROST–SERIES BORINGS REPRESENT THE LOCATION AND VERTICAL EXTENT OF THE PETROLEUM HYDROCARBONS DETECTED BY THE ROST™ TECHNOLOGY. THE PRESENCE OF A COLOR BAR IS NOT A REPRESENTATION OF LIGHT NON–AQUEOUS PHASE LIQUID THICKNESS.
5. TWO OR MORE OF THE INDIVIDUAL HYDROCARBON COLORS REPRESENT COMMINGLED PETROLEUM HYDROCARBONS.
6. NO APPARENT PETROLEUM HYDROCARBONS WERE DETECTED AT THOSE HROST–SERIES BORINGS WITHOUT A VERTICAL COLOR BAR.
7. MAIN SAND, EPA STRATUM, RAND STRATUM AND NORTH OLIVE STRATUM ARE NAMES DEVELOPED FOR LOCAL HYDROSTRATIGRAPHIC UNITS.
8. WELLS MAY BE PROJECTED ONTO THE CROSS SECTION.

SCALE IN FEET

0 150 300 600

VERTICAL SCALE: 1' = 20'

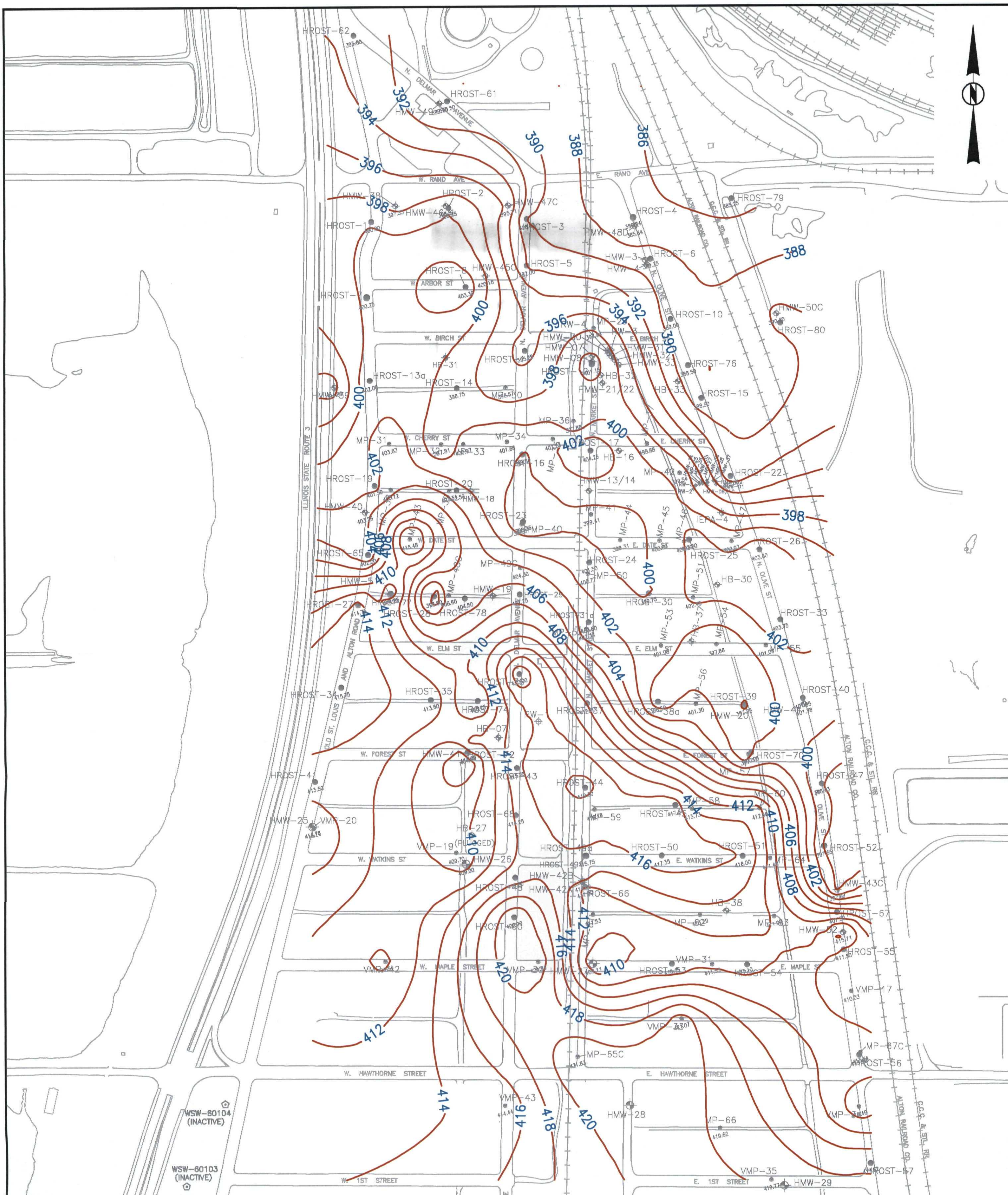
CHECK BY	
DRAWN BY	BCP
DATE	10–29–04
SCALE	AS SHOWN
CAD NO.	0309514006E4
PRJ NO.	15–03095.14

CROSS SECTIONS I–I', J–J', AND K–K'

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5–8



LEGEND:

—400— STRUCTURAL SURFACE CONTOUR (TOP)

399.25 STRUCTURAL SURFACE ELEVATION (TOP)

CPT/ROST™ INVESTIGATION LOCATION

EXISTING MONITORING WELL (HB, HMW, P, SP, RB)

RECOVERY WELL (RW)

PUBLIC WATER SUPPLY WELL (WSW)

MONITORING PROBE (MP, VMP)

NOTES:

1. CONTOUR INTERVAL = 2 FT.

2. GROUND SURFACE ELEVATIONS FOR HROST SERIES LOCATIONS ARE APPROXIMATE AND WERE ESTIMATED FROM AVAILABLE NEARBY GROUND SURFACE ELEVATION SURVEY DATA AT VILLAGE MONITORING WELLS AND SELECTED SANITARY SEWER MANHOLES. GROUND SURFACE ELEVATIONS FOR HMW-25 AND HIGHER SERIES BORINGS AND MP SERIES WERE DETERMINED BY A 2004 SURVEY BY CMT, INC.

SCALE IN FEET

0 150 300 600

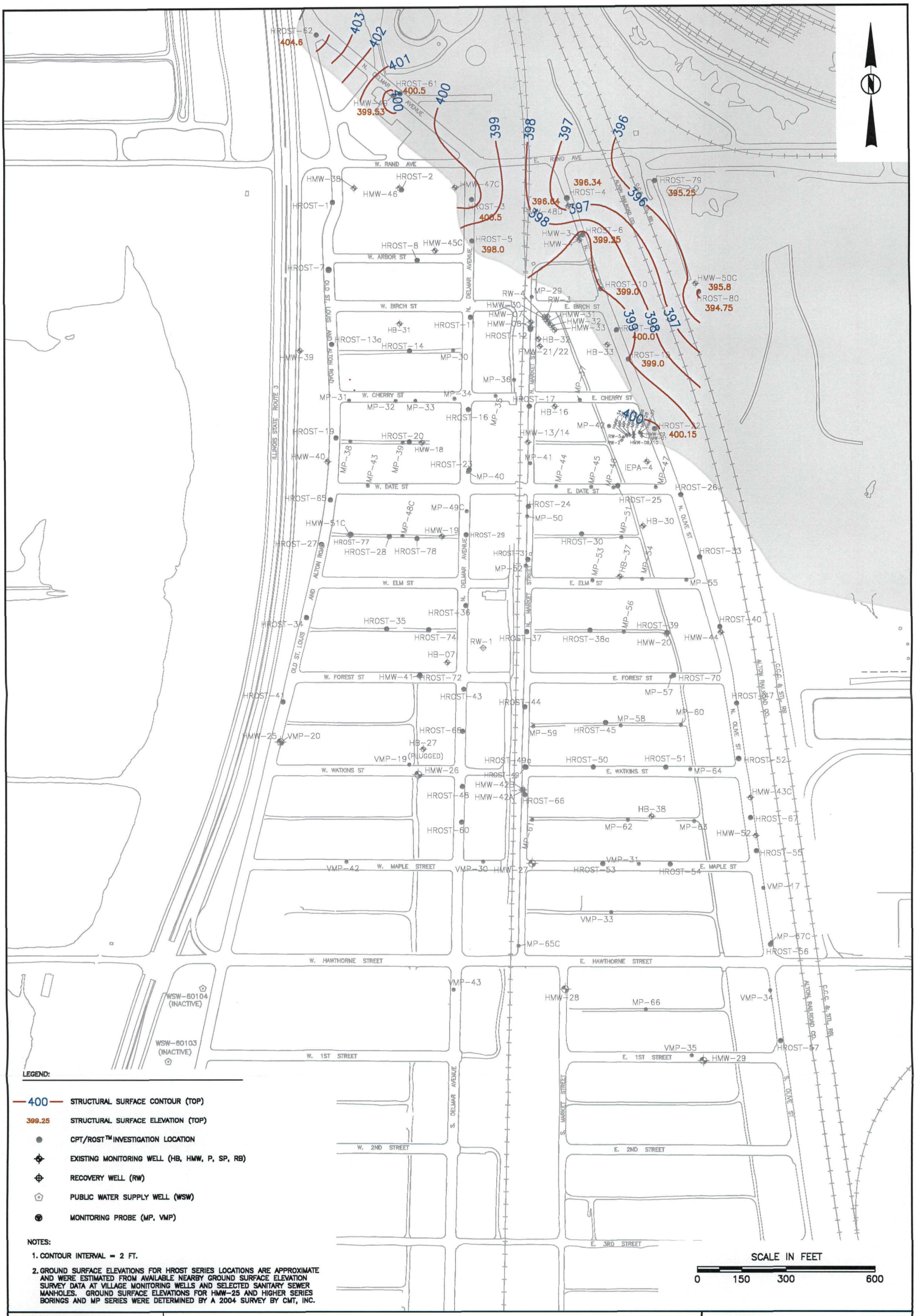
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x1
PRJ NO.	15-03095.14

STRUCTURAL CONTOUR MAP – TOP OF MAIN SAND

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-9



LEGEND:

- —400— STRUCTURAL SURFACE CONTOUR (TOP)
- 399.25 STRUCTURAL SURFACE ELEVATION (TOP)
- ● CPT/ROST™ INVESTIGATION LOCATION
- ⊕ EXISTING MONITORING WELL (HB, HMW, P, SP, RB)
- ⊕ RECOVERY WELL (RW)
- ⬠ PUBLIC WATER SUPPLY WELL (WSW)
- ▼ MONITORING PROBE (MP, VMP)

NOTES:

1. CONTOUR INTERVAL = 2 FT.
2. GROUND SURFACE ELEVATIONS FOR HROST SERIES LOCATIONS ARE APPROXIMATE AND WERE ESTIMATED FROM AVAILABLE NEARBY GROUND SURFACE ELEVATION SURVEY DATA AT VILLAGE MONITORING WELLS AND SELECTED SANITARY SEWER MANHOLES. GROUND SURFACE ELEVATIONS FOR HMW-25 AND HIGHER SERIES BORINGS AND MP SERIES WERE DETERMINED BY A 2004 SURVEY BY CMT, INC.

SCALE IN FEET

0 150 300 600

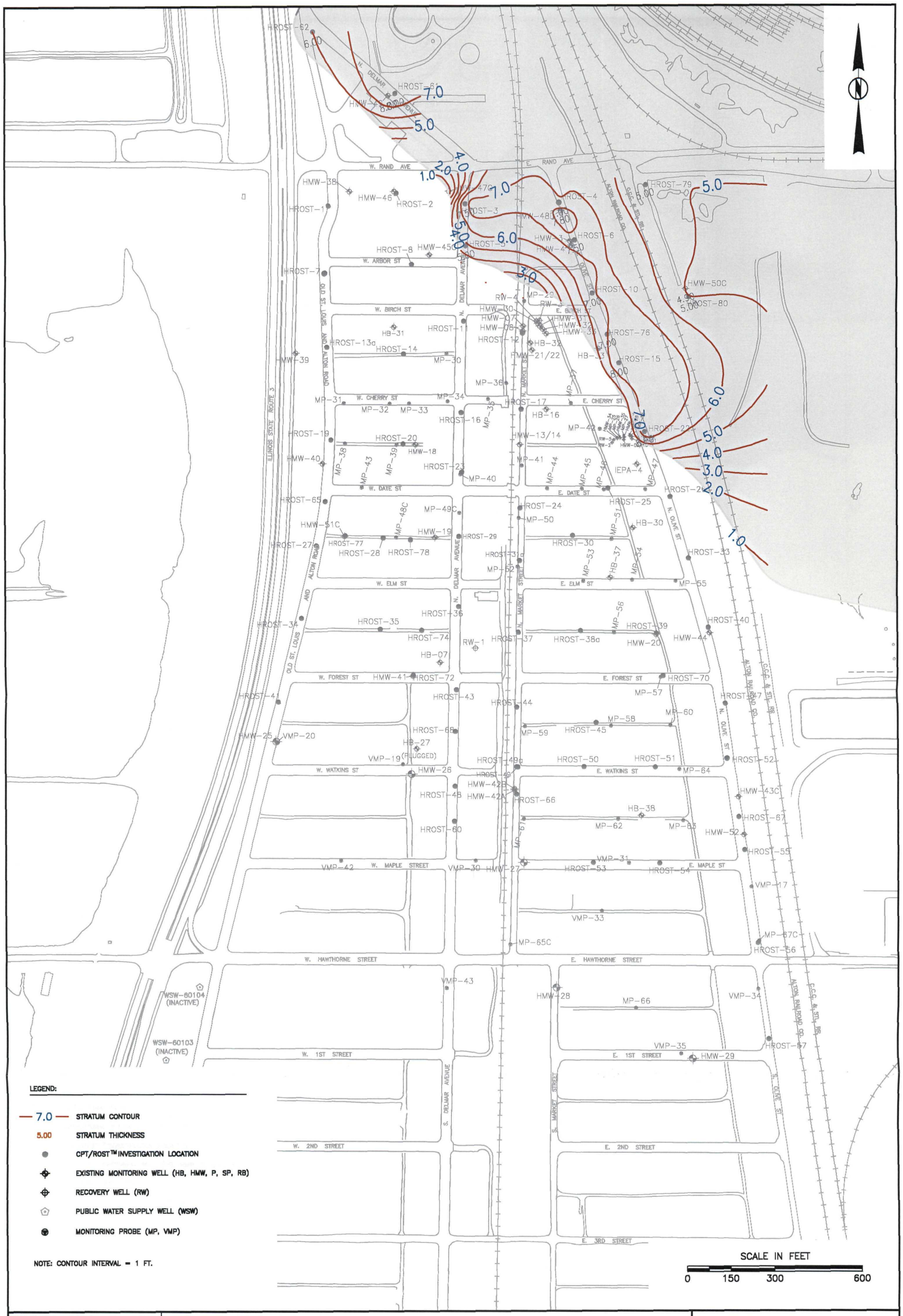
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x2
PRJ NO.	15-03095.14

STRUCTURAL CONTOUR MAP – TOP OF EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-10



CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x3
PRJ NO.	15-03095.14

ISOPACH OF THE EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-11

LEGEND:

- 410 — STRUCTURAL SURFACE CONTOUR (TOP)
- 411.51 STRUCTURAL SURFACE ELEVATION (TOP)
- CPT/ROST™ INVESTIGATION LOCATION
- EXISTING MONITORING WELL (HB, HMW, P, SP, RB)
- RECOVERY WELL (RW)
- PUBLIC WATER SUPPLY WELL (WSW)
- MONITORING PROBE (MP, VMP)

NOTES:

1. CONTOUR INTERVAL = 1 FT.
2. GROUND SURFACE ELEVATIONS FOR HROST SERIES LOCATIONS ARE APPROXIMATE AND WERE ESTIMATED FROM AVAILABLE NEARBY GROUND SURFACE ELEVATION SURVEY DATA AT VILLAGE MONITORING WELLS AND SELECTED SANITARY SEWER MANHOLES. GROUND SURFACE ELEVATIONS FOR HMW-25 AND HIGHER SERIES BORINGS AND MP SERIES WERE DETERMINED BY A 2004 SURVEY BY CMT, INC.

CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x4
PRJ NO.	15-03095.14

STRUCTURAL CONTOUR MAP – TOP OF RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-12

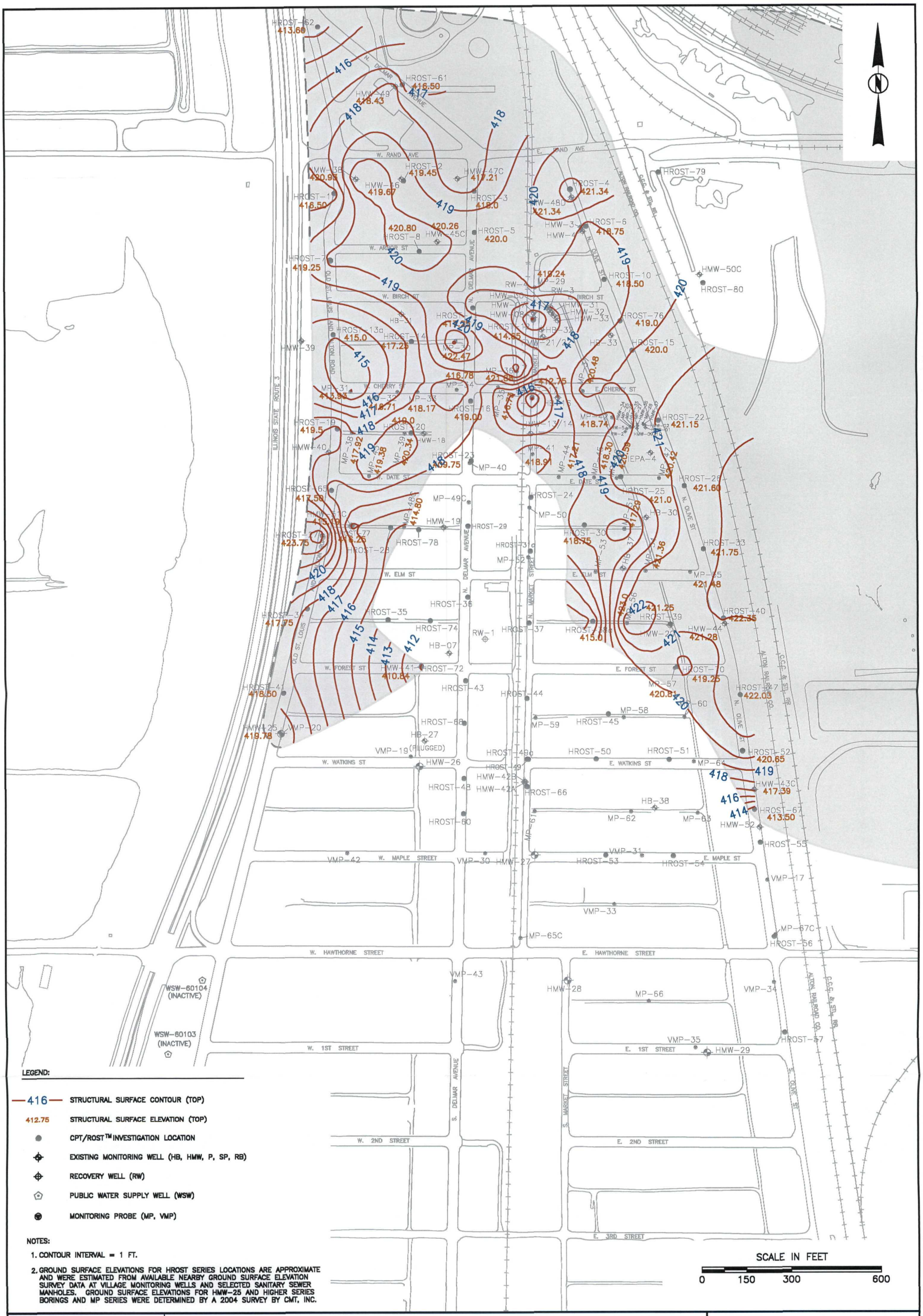
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x5
PRJ NO.	15-03095.14

ISOPACH OF THE RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-13



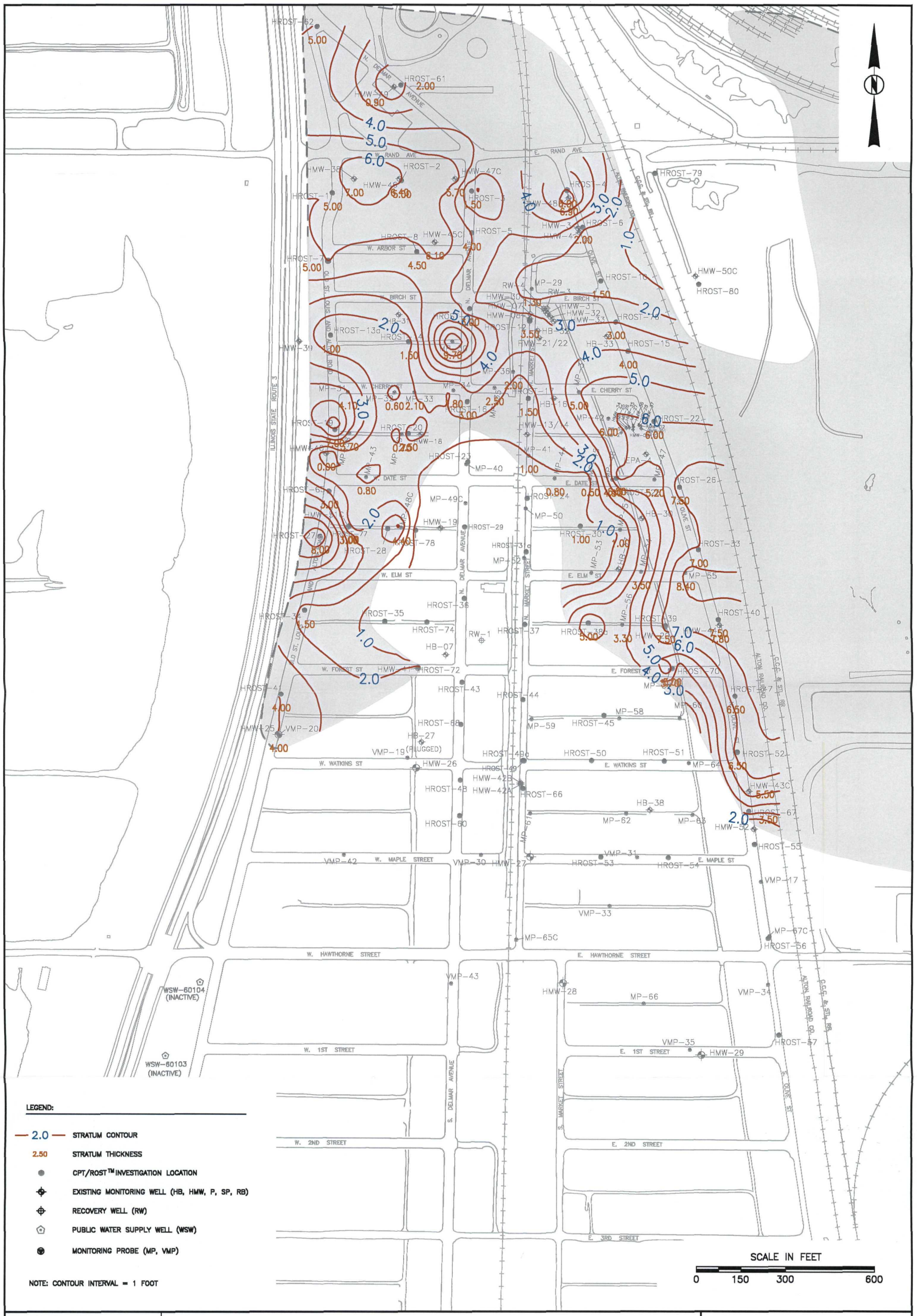
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x6
PRJ NO.	15-03095.14

STRUCTURAL CONTOUR MAP – TOP OF NORTH OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-14



CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x7
PRJ NO.	15-03095.14

ISOPACH OF THE NORTH OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-15

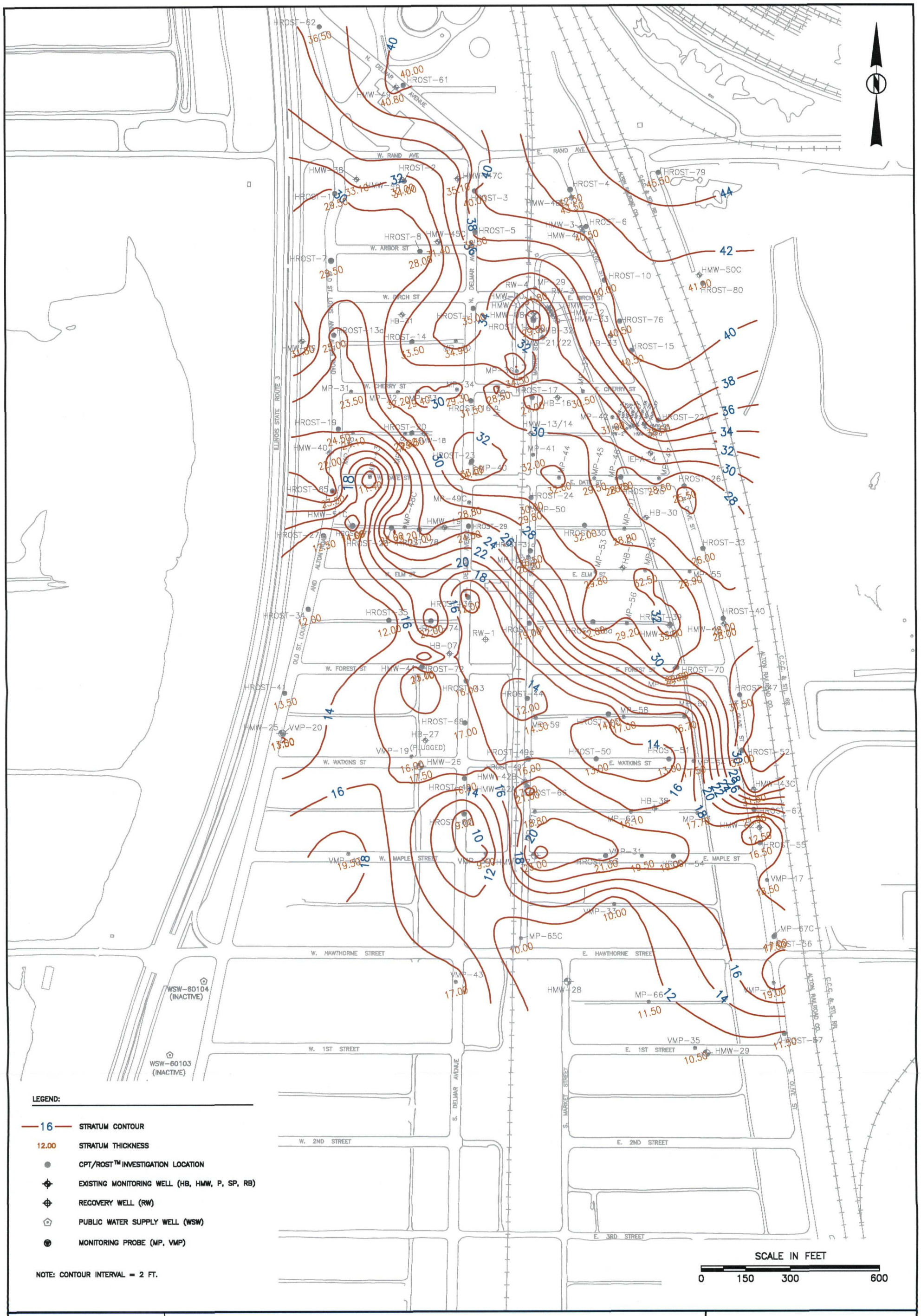
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x8
PRJ NO.	15-03095.14

ISOPACH OF THE CLAY OVERLYING
THE NORTH OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-16



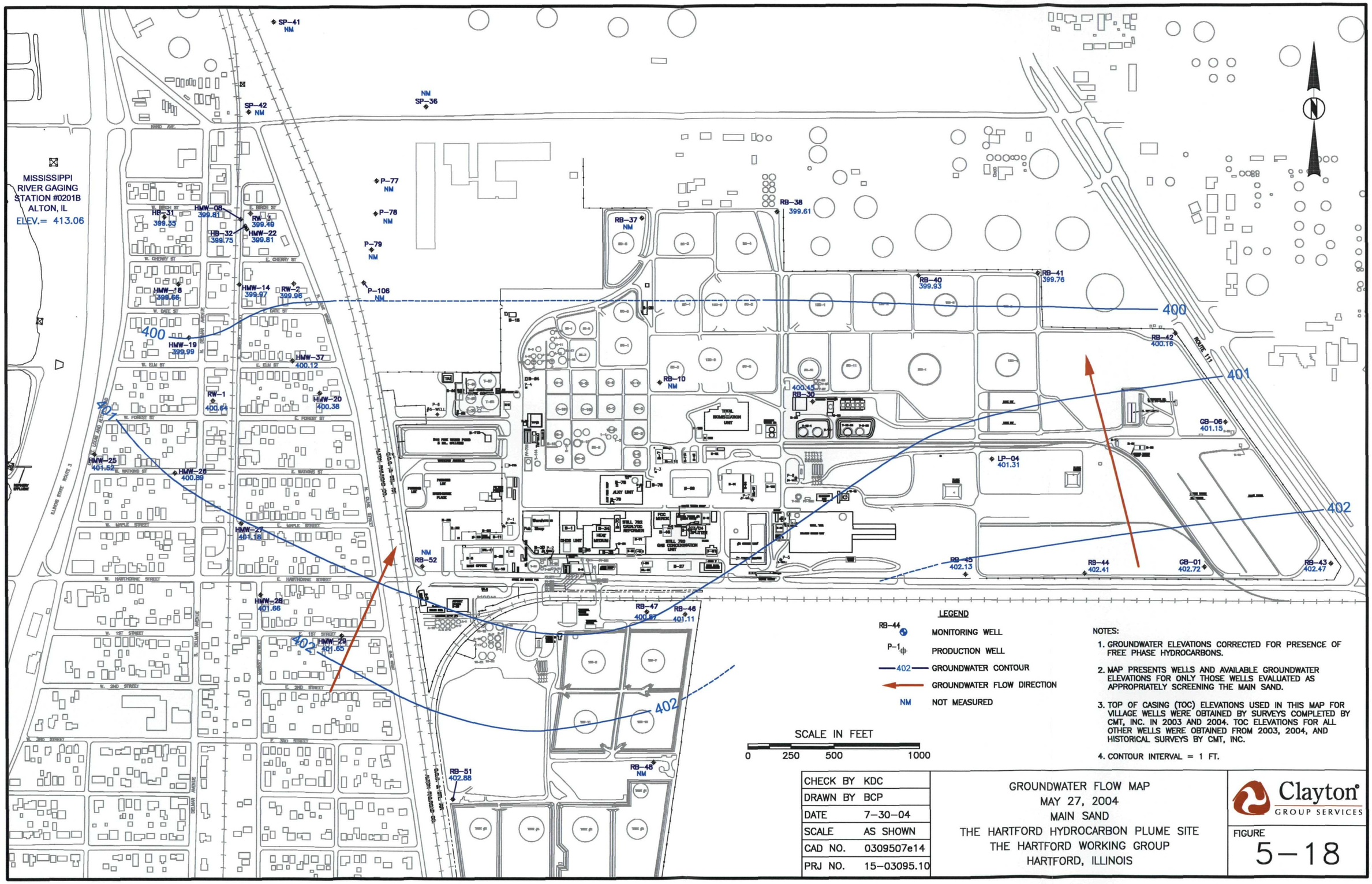
CHECK BY	MMN
DRAWN BY	BCP
DATE	10-29-2004
SCALE	AS SHOWN
CAD NO.	0309514006x9
PRJ NO.	15-03095.14

ISOPACH OF THE TOTAL CLAY AND SILT
OVERLYING THE MAIN SAND

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-17



NOTES:

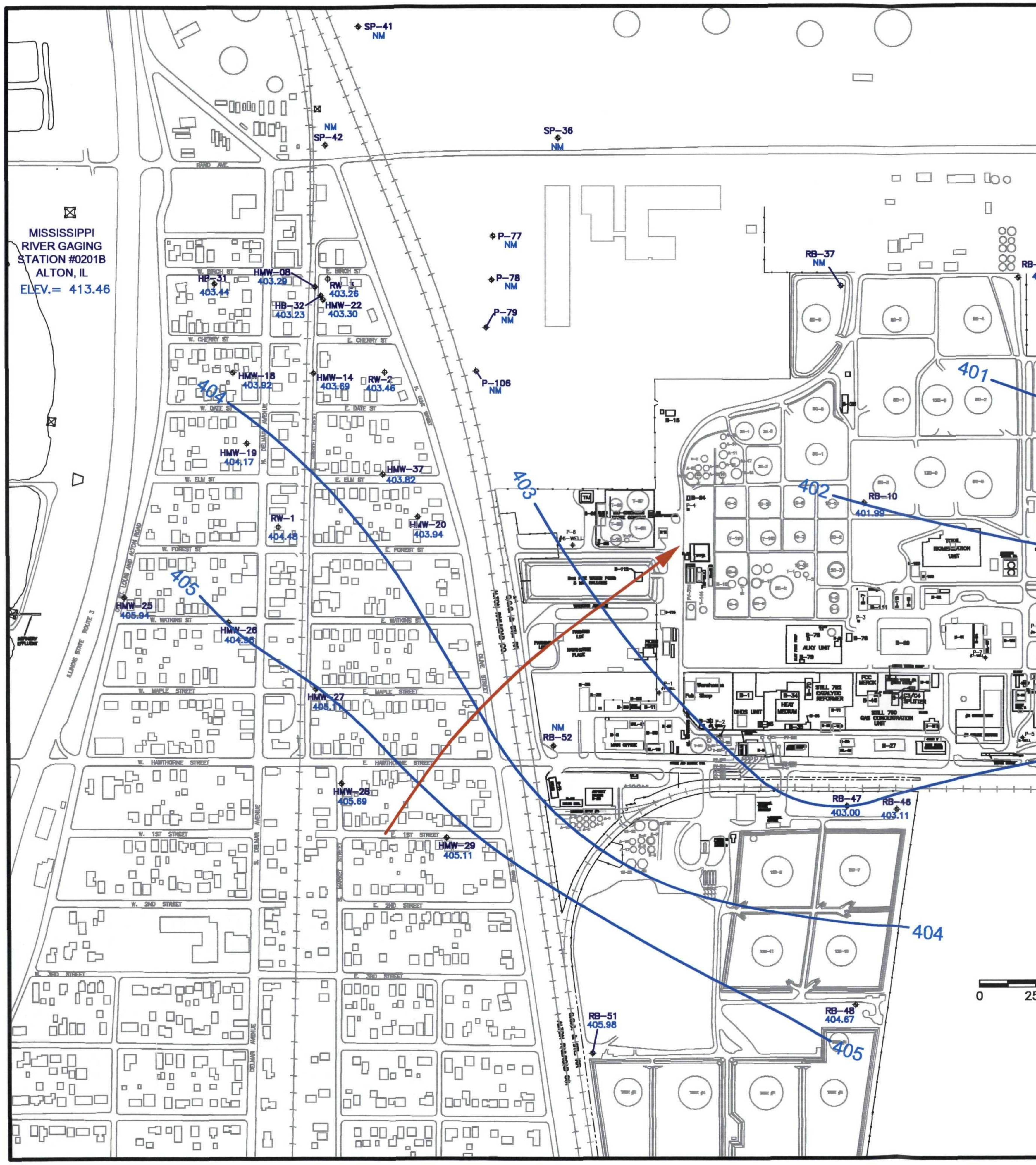
1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.

CHECK BY	KDC
DRAWN BY	BCP
DATE	7-30-04
SCALE	AS SHOWN
CAD NO.	0309507e14
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
MAY 27, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
5-18



LEGEND

RB-44	MONITORING WELL
P-1	PRODUCTION WELL
—402—	GROUNDWATER CONTOUR
←	GROUNDWATER FLOW DIRECTION
NM	NOT MEASURED

NOTES:

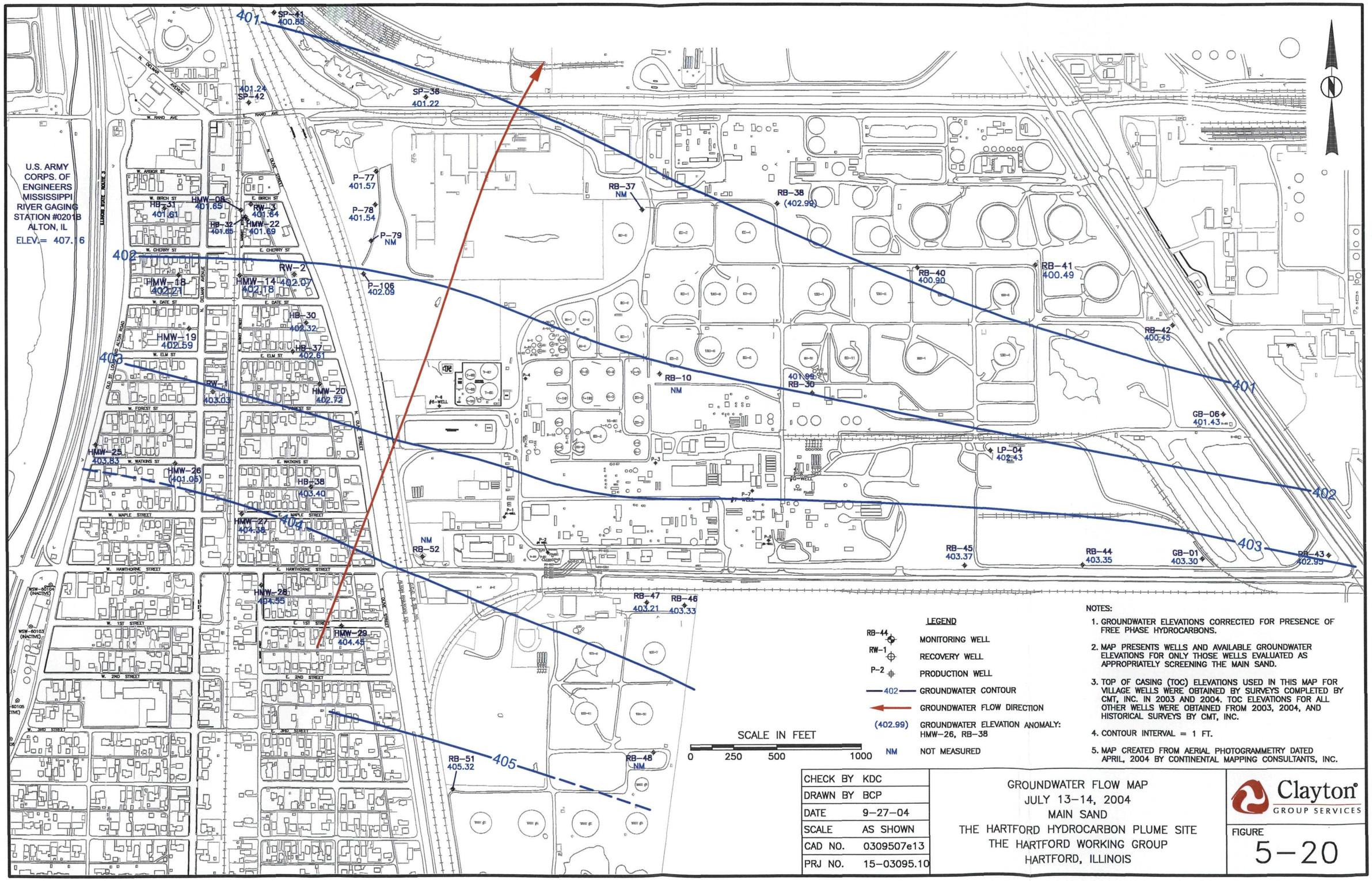
1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.

CHECK BY	KDC
DRAWN BY	BCP
DATE	7-30-04
SCALE	AS SHOWN
CAD NO.	0309507e15
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
JUNE 30, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-19



NOTES:

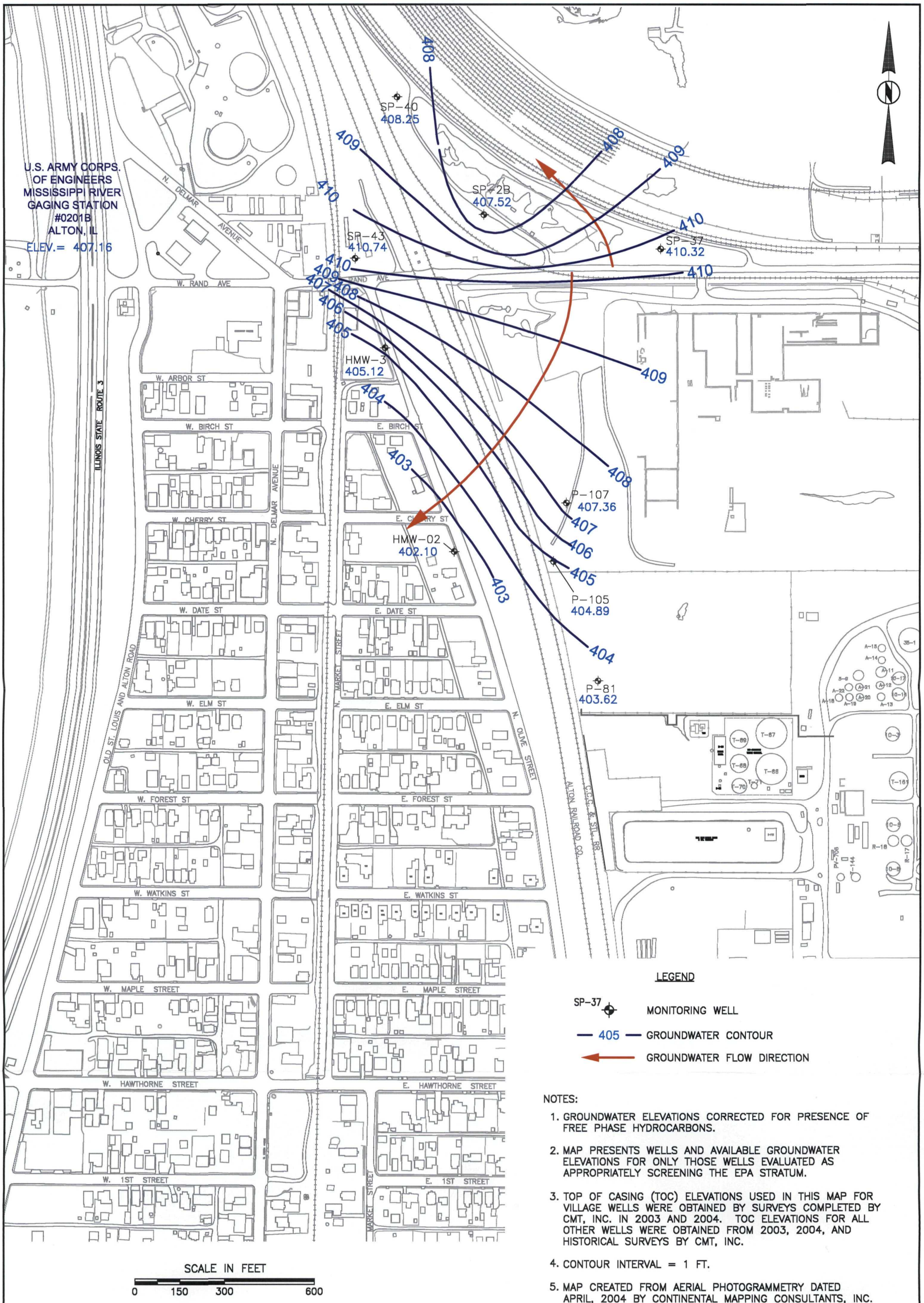
1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

CHECK BY	KDC
DRAWN BY	BCP
DATE	9-27-04
SCALE	AS SHOWN
CAD NO.	0309507e13
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
JULY 13-14, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
5-20



NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE EPA STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

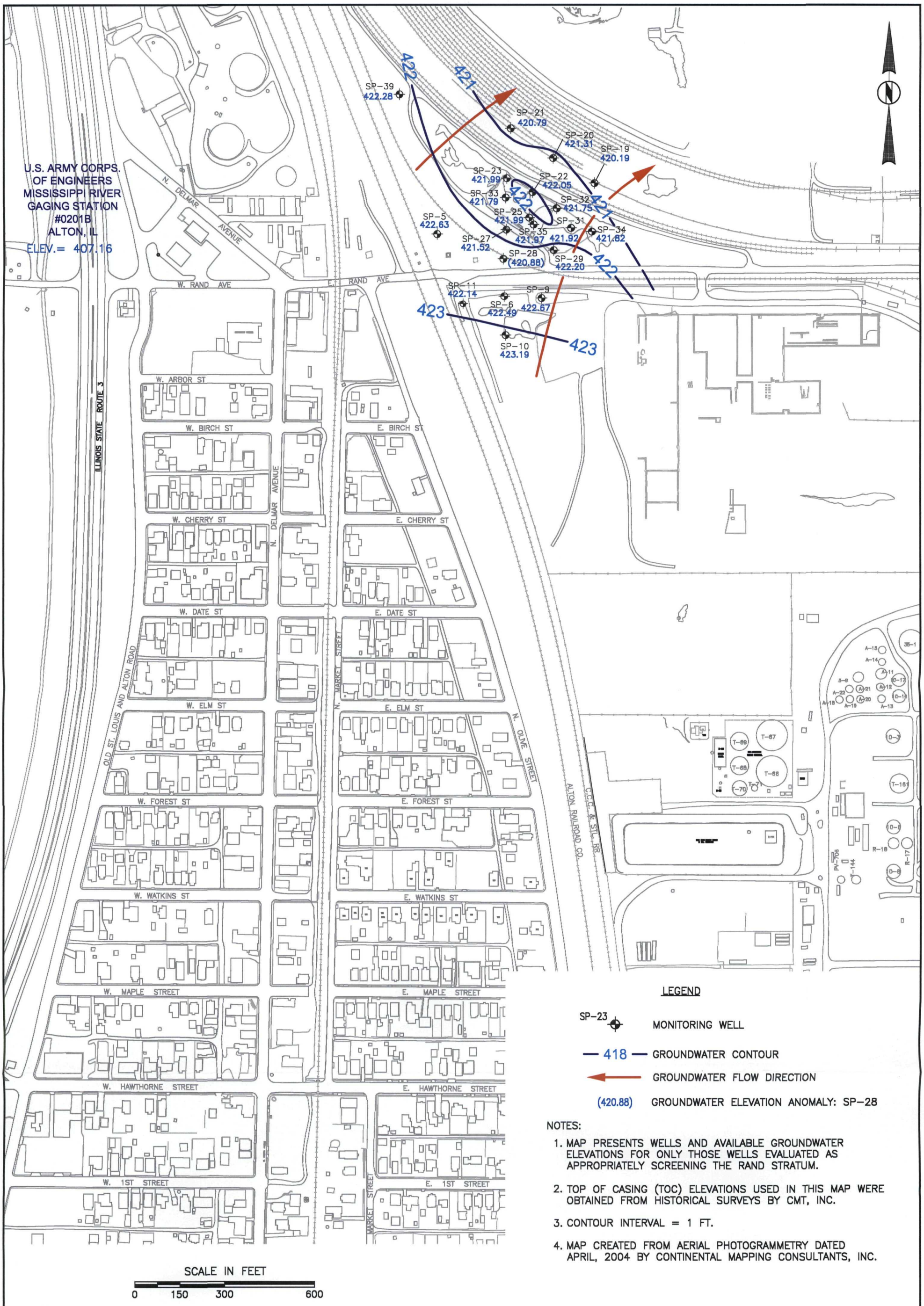
CHECK BY	KDC
DRAWN BY	BCP
DATE	9-27-04
SCALE	AS SHOWN
CAD NO.	0309507e11
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
JULY 13-14, 2004 - EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5-21



LEGEND

SP-23 — MONITORING WELL

418 — GROUNDWATER CONTOUR

GROUNDWATER FLOW DIRECTION

(420.88) GROUNDWATER ELEVATION ANOMALY: SP-28

NOTES:

1. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
2. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP WERE OBTAINED FROM HISTORICAL SURVEYS BY CMT, INC.
3. CONTOUR INTERVAL = 1 FT.
4. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

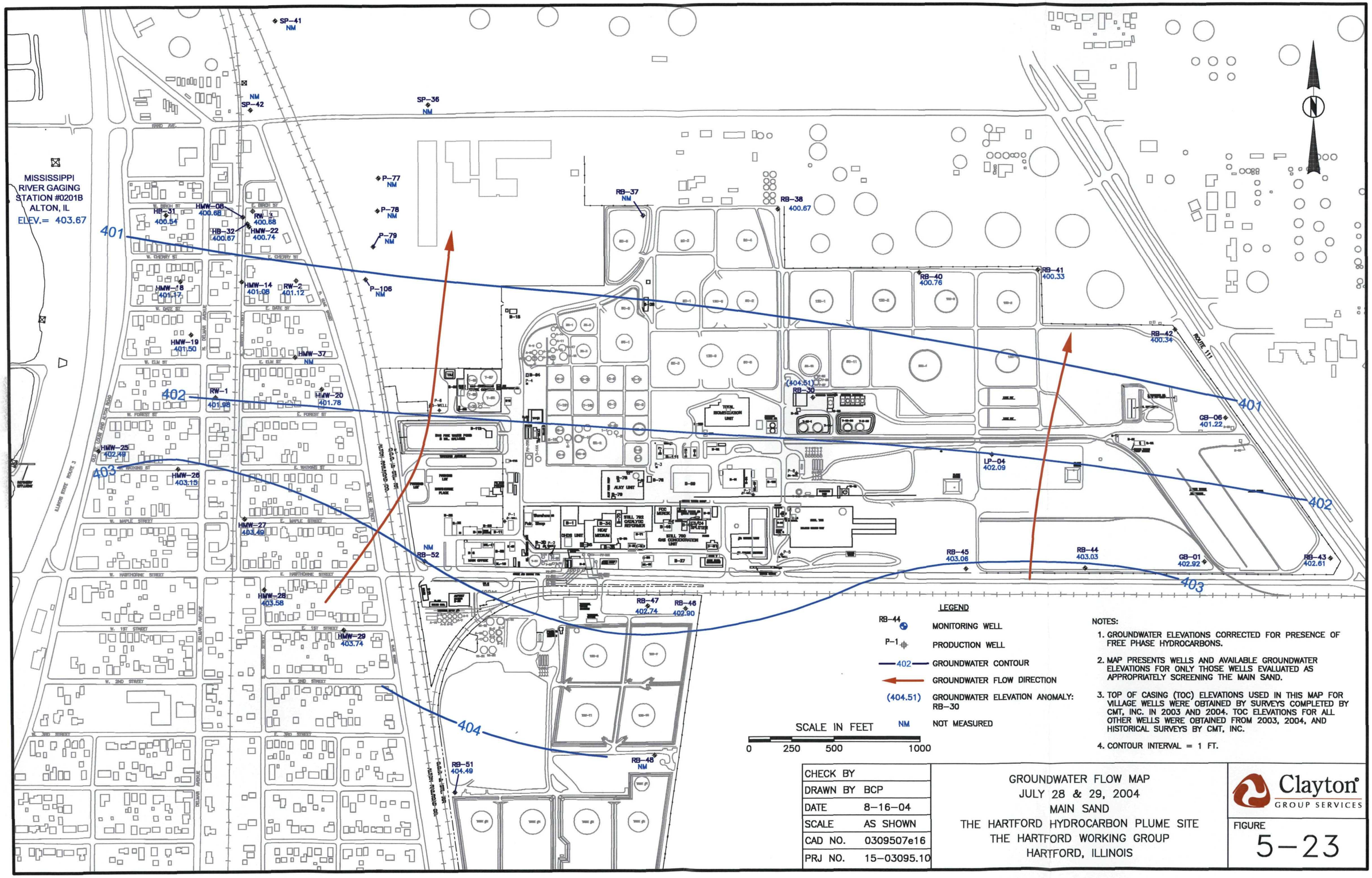
CHECK BY	KDC
DRAWN BY	BCP
DATE	9-27-04
SCALE	AS SHOWN
CAD NO.	0309507e12
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
JULY 13-14, 2004 - RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5-22



LEGEND

RB-44	MONITORING WELL
P-1	PRODUCTION WELL
402	GROUNDWATER CONTOUR
	GROUNDWATER FLOW DIRECTION
(404.51)	GROUNDWATER ELEVATION ANOMALY: RB-30
NM	NOT MEASURED

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.

CHECK BY	
DRAWN BY	BCP
DATE	8-16-04
SCALE	AS SHOWN
CAD NO.	0309507e16
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
JULY 28 & 29, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
5-23

U.S. ARMY CORPS. OF ENGINEERS MISSISSIPPI RIVER GAGING STATION #0201B ALTON, IL

ELEV.= 401.62

SP-42 NM

SP-36 NM

P-77 NM

P-78 NM

P-79 NM

P-106 NM

RB-37 NM

RB-38 400.47

RB-40 400.60

RB-41 400.25

RB-42 400.32

RB-30 401.38

GB-06 401.25

LP-04 401.97

RB-52 NM

RB-45 402.89

RB-44 402.98

GB-01 402.98

RB-43 402.71

RB-47 402.08

RB-46 402.33

RB-48 NM

RB-51 403.77

HMW-08 400.07

RW-3 400.08

HB-31 399.85

HB-32 400.09

HMW-22 400.19

HMW-18 400.46

HMW-14 400.62

RW-2 400.66

HMW-19 400.80

HMW-37 NM

RW-1 401.29

HMW-20 401.23

HMW-25 401.55

HMW-26 402.30

HMW-27 402.65

HMW-28 402.73

HMW-29 403.08

WSW-60104 (INACTIVE)

WSW-60103 (INACTIVE)

400

401

402

403

W. RAND AVE.

E. RAND AVE.

W. ARBOR ST

W. BIRCH ST

E. BIRCH ST

W. CHERRY ST

E. CHERRY ST

W. DATE ST

E. DATE ST

W. ELM ST

E. ELM ST

W. FOREST ST

E. FOREST ST

W. WATKINS ST

E. WATKINS ST

W. MAPLE STREET

E. MAPLE STREET

W. HAWTHORNE STREET

E. HAWTHORNE STREET

W. 1ST STREET

E. 1ST STREET

W. 2ND STREET

E. 2ND STREET

W. 3RD STREET

3RD STREET

DELMAR AVENUE

MARKET STREET

N. OAK STREET

S. OAK STREET

OLD ST. LOUIS AND ALTON ROAD

P-4 #6-WELL

P-3

P-7 #7-WELL

P-2

SCALE IN FEET

0 250 500 1000

LEGEND

RB-44 MONITORING WELL

RW-1 RECOVERY WELL

P-2 PRODUCTION WELL

402 GROUNDWATER CONTOUR

GROUNDWATER FLOW DIRECTION

NM NOT MEASURED

NOTES:

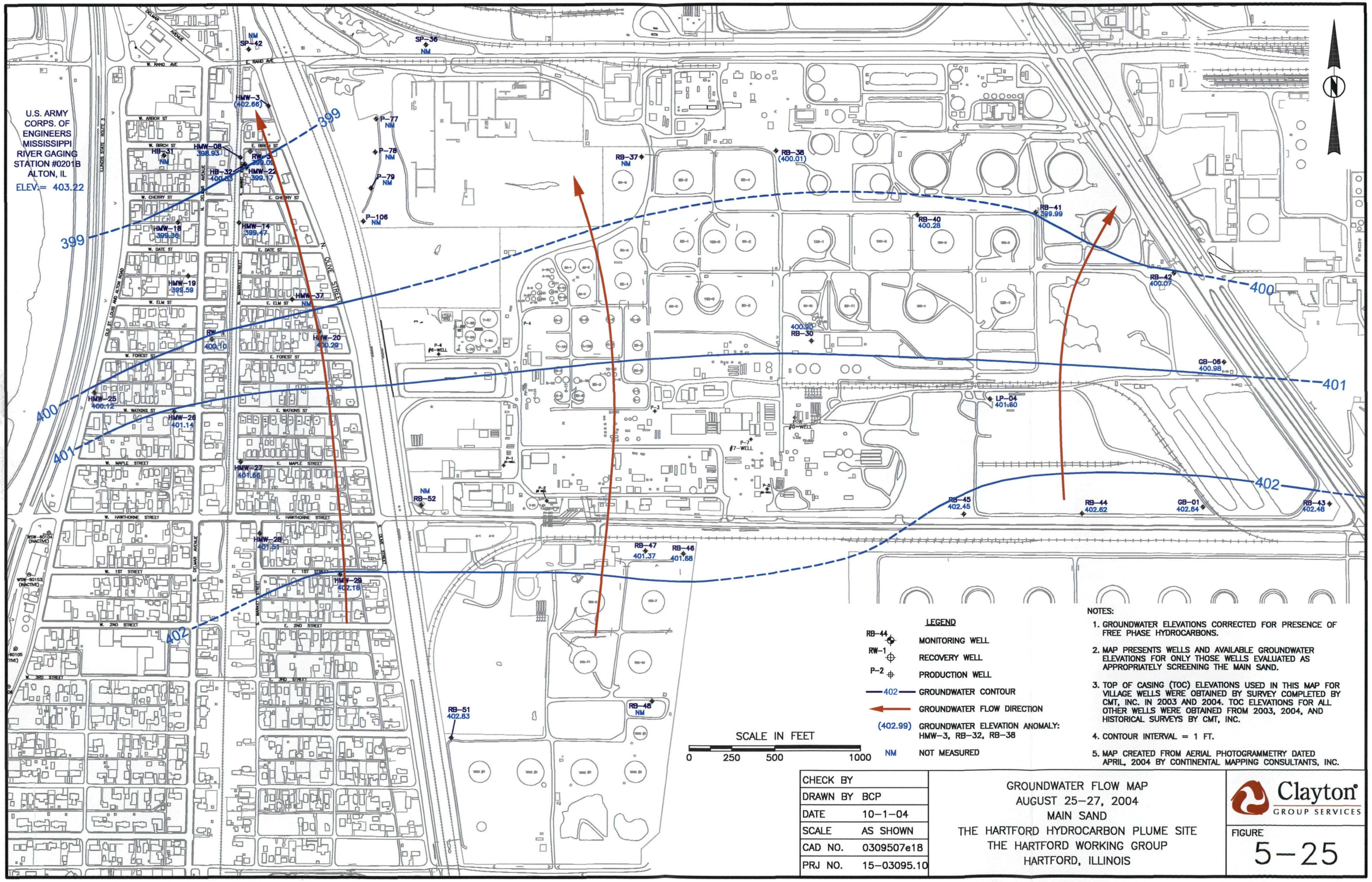
1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

CHECK BY	KDC
DRAWN BY	BCP
DATE	8-17-04
SCALE	AS SHOWN
CAD NO.	0309507e17
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
AUGUST 11, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5-24



LEGEND

- RB-44 — MONITORING WELL
- RW-1 — RECOVERY WELL
- P-2 — PRODUCTION WELL
- 402 — GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- (402.99) — GROUNDWATER ELEVATION ANOMALY: HMW-3, RB-32, RB-38
- NM — NOT MEASURED

SCALE IN FEET

0 250 500 1000

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

CHECK BY	
DRAWN BY	BCP
DATE	10-1-04
SCALE	AS SHOWN
CAD NO.	0309507e18
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
AUGUST 25-27, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
5-25

U.S. ARMY CORPS. OF ENGINEERS MISSISSIPPI RIVER GAGING STATION #0201B ALTON, IL

ELEV.= 400.58

SCALE IN FEET

0 250 500 1000

LEGEND

- RB-44 — MONITORING WELL
- RW-1 — RECOVERY WELL
- MP-29 — MONITORING PROBE
- P-2 — PRODUCTION WELL
- 402 — GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- (402.99) — GROUNDWATER ELEVATION ANOMALY: MP-32C, MP-40C, MP-49C, MP-60C, HMW-39C, RB-47
- NM — NOT MEASURED

NOTES:

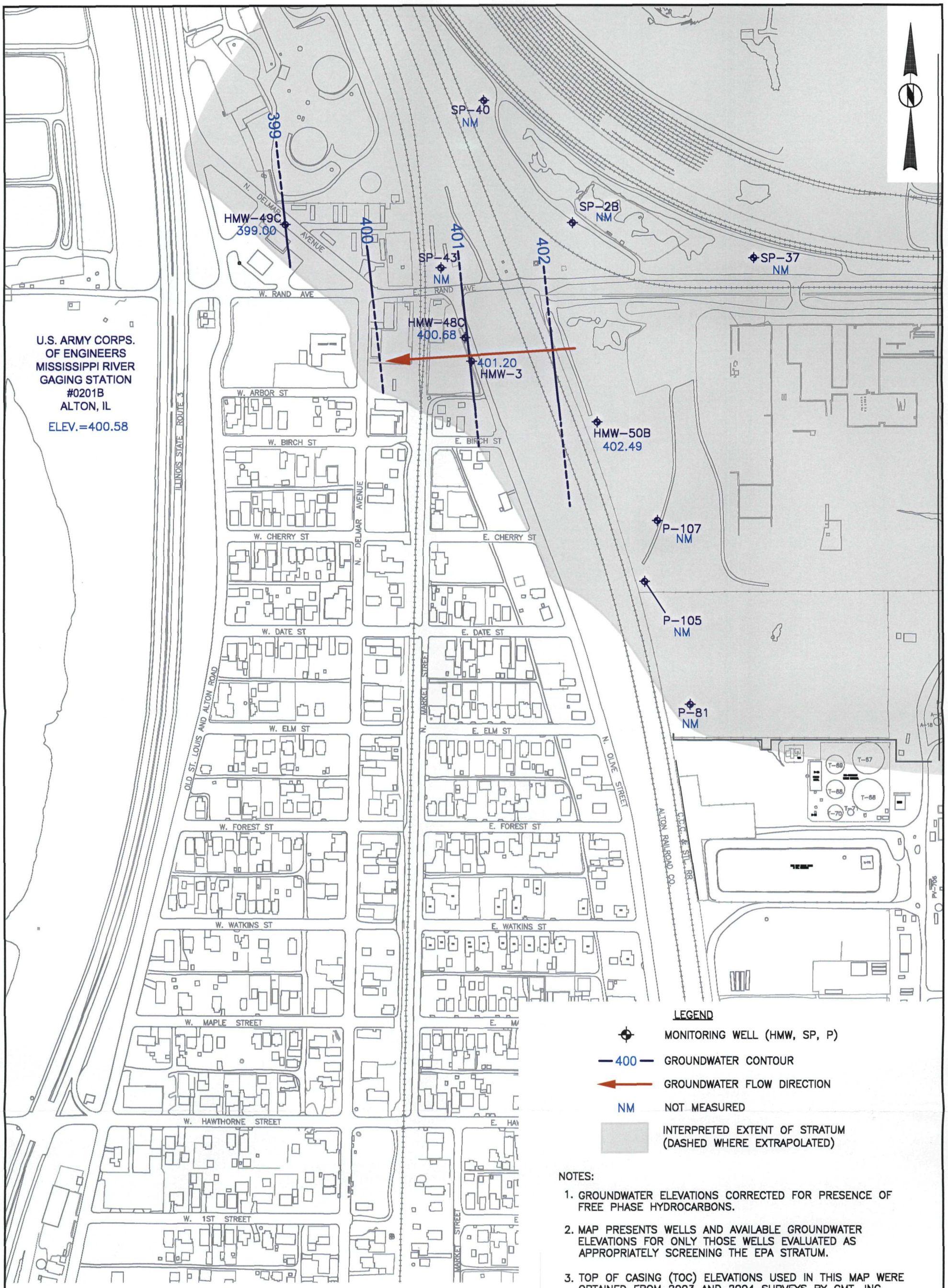
1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE MAIN SAND.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

CHECK BY	
DRAWN BY	BCP
DATE	10-29-04
SCALE	AS SHOWN
CAD NO.	0309507e22
PRJ NO.	15-03095.10

GROUNDWATER FLOW MAP
SEPTEMBER 20-22, 2004
MAIN SAND
THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
5-26



NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE EPA STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP WERE OBTAINED FROM 2003 AND 2004 SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

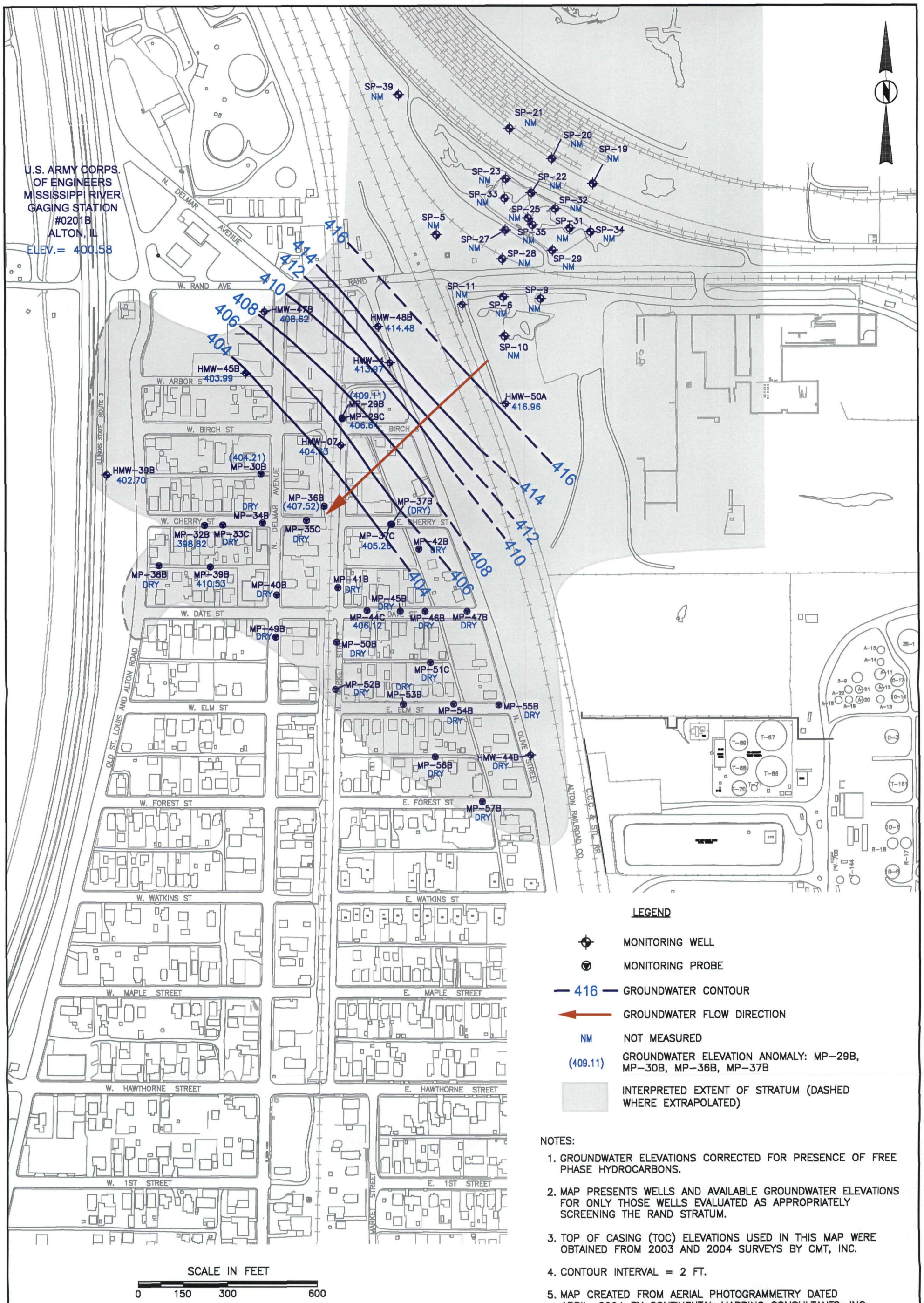
CHECK BY	KDC
DRAWN BY	BCP
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309507e19
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
SEPTEMBER 20-22, 2004 - EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-27



LEGEND

- MONITORING WELL
- MONITORING PROBE
- 416 — GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- NM — NOT MEASURED
- (409.11) — GROUNDWATER ELEVATION ANOMALY: MP-29B, MP-30B, MP-36B, MP-37B
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP WERE OBTAINED FROM 2003 AND 2004 SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 2 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

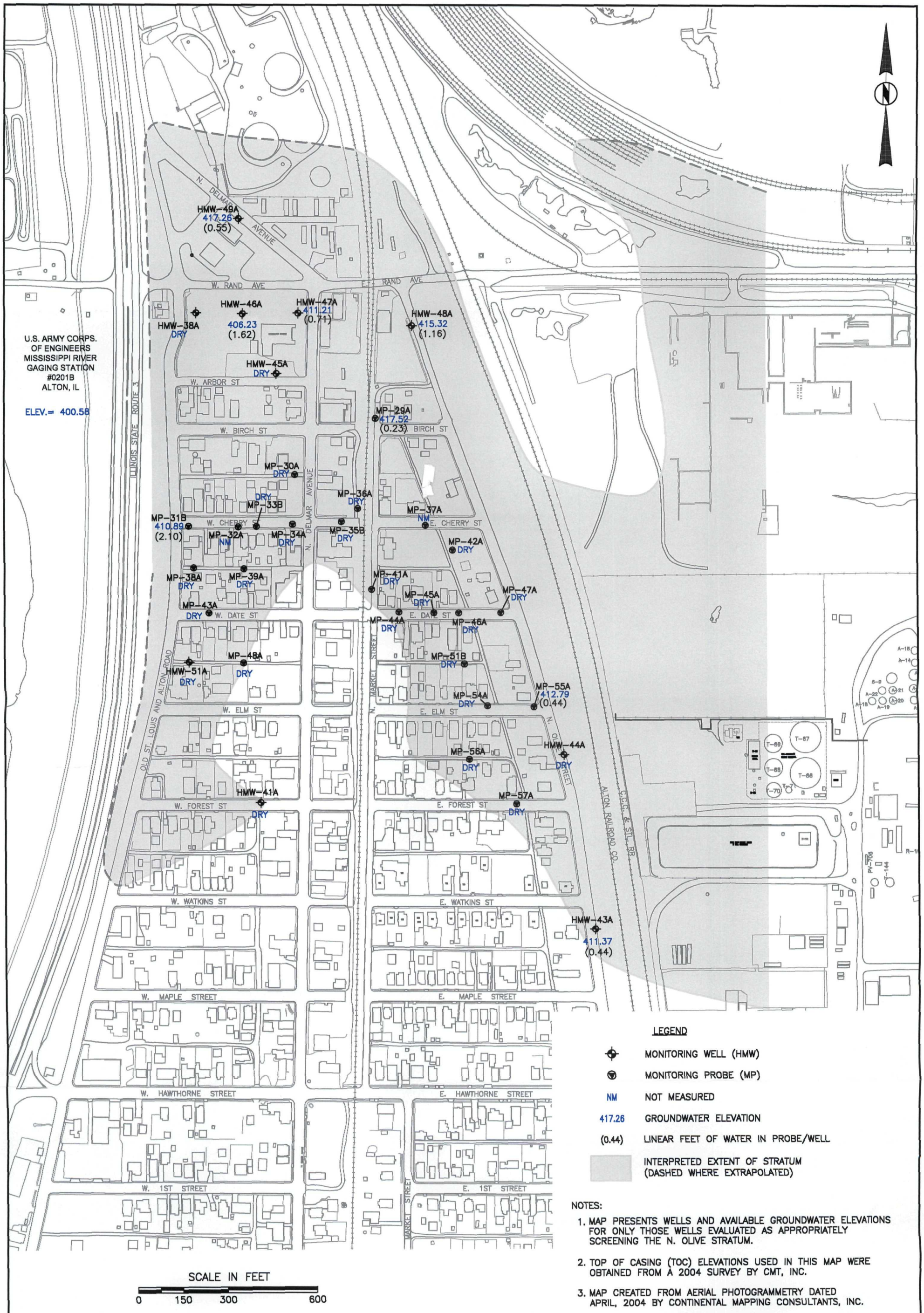
CHECK BY	KDC
DRAWN BY	BCP
DATE	10-1-04
SCALE	AS SHOWN
CAD NO.	0309507e20
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
SEPTEMBER 20-22, 2004 – RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 5-28



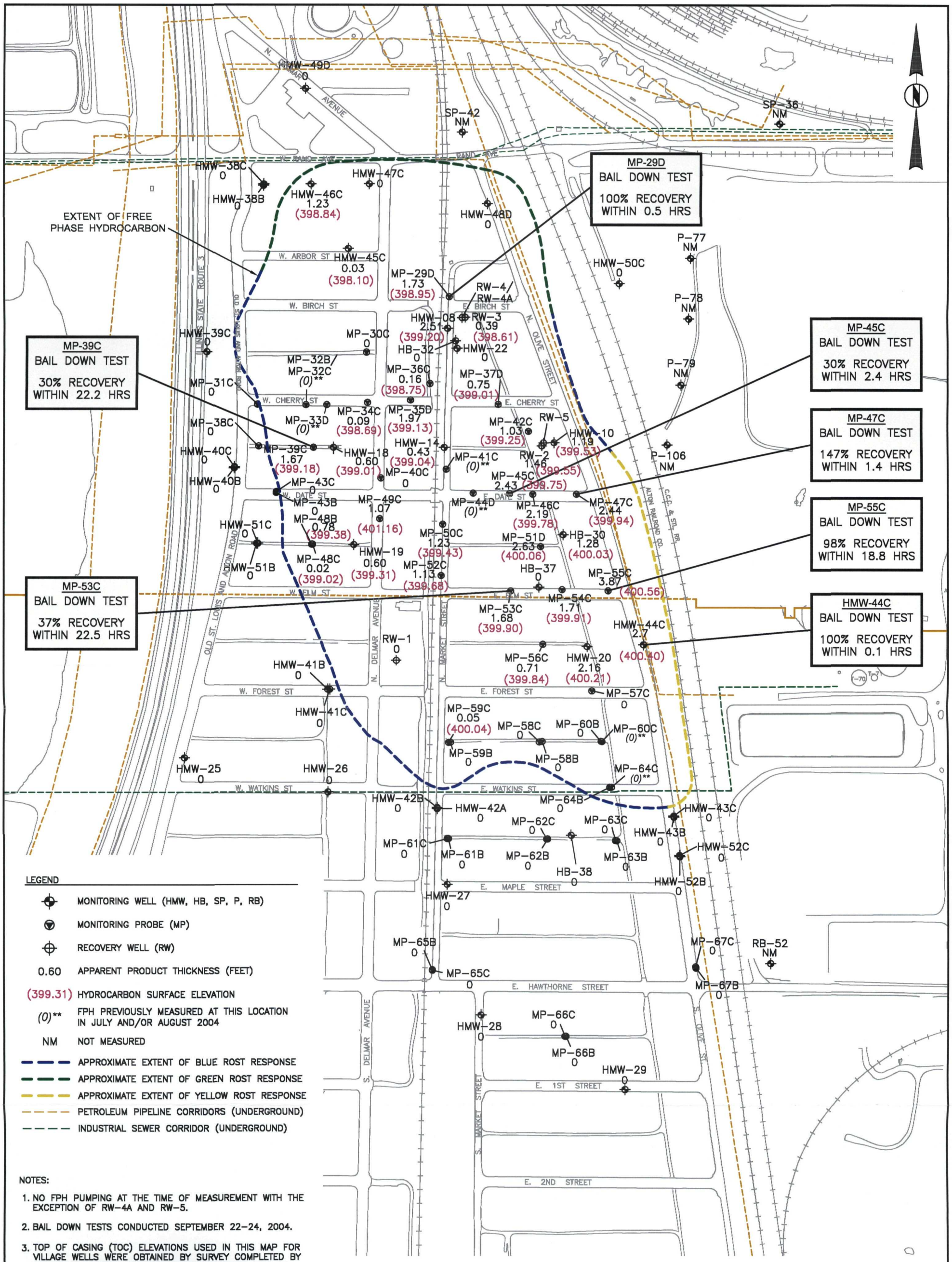
CHECK BY	KDC
DRAWN BY	BCP
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309507e21
PRJ NO.	15-03095

GROUNDWATER ELEVATION MAP
SEPTEMBER 20-22, 2004 – N. OLIVE STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE 5-29



NOTES:

1. NO FPH PUMPING AT THE TIME OF MEASUREMENT WITH THE EXCEPTION OF RW-4A AND RW-5.
2. BAIL DOWN TESTS CONDUCTED SEPTEMBER 22-24, 2004.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

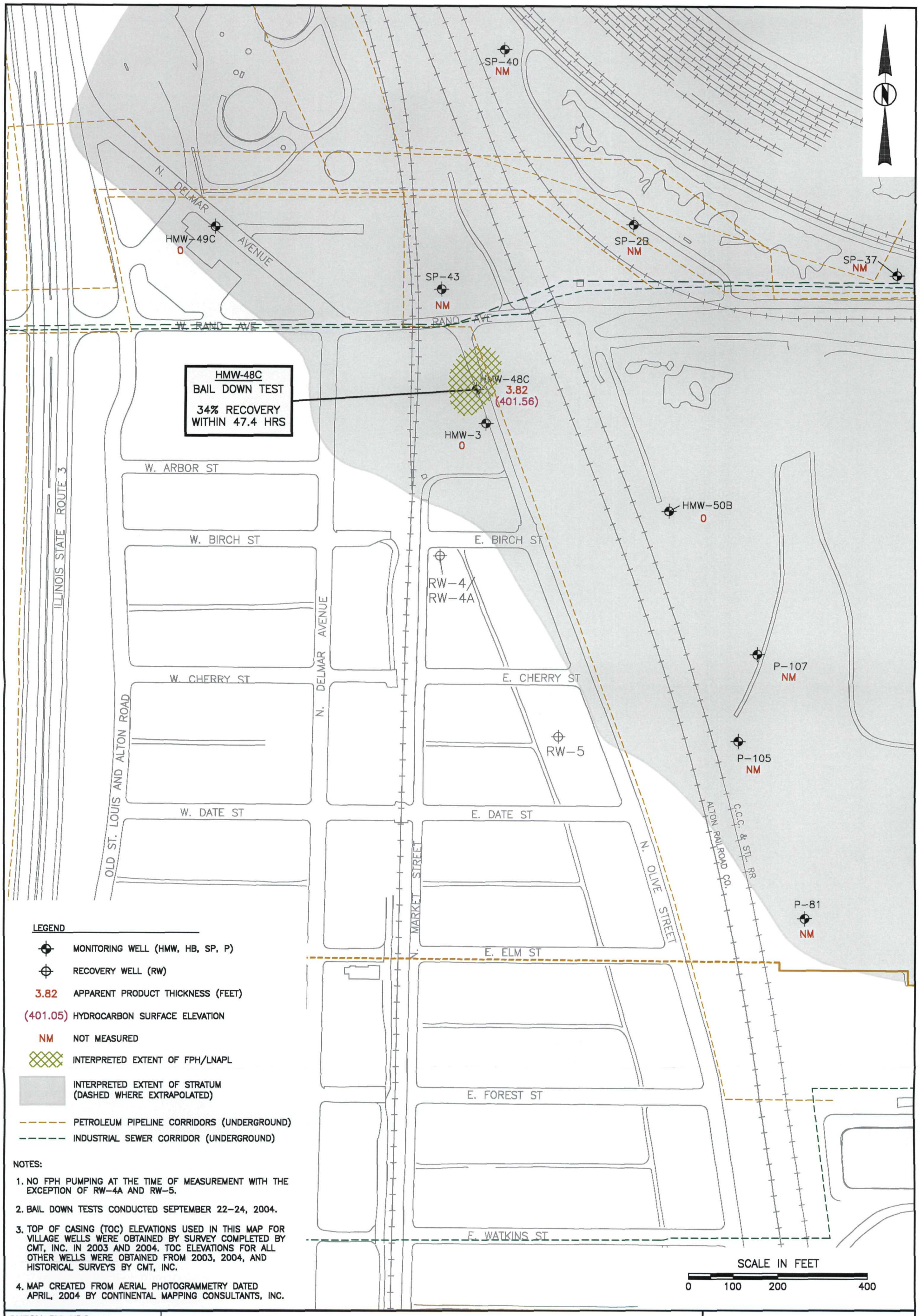
CHECK BY	KDC
DRAWN BY	BCP
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309514006J
PRJ NO.	15-03095

APPARENT FPH/LNAPL PRODUCT THICKNESS AND ELEVATION MAP
SEPTEMBER 20-22, 2004 - MAIN SAND

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 6-1



LEGEND

- MONITORING WELL (HMW, HB, SP, P)
- RECOVERY WELL (RW)
- 3.82 APPARENT PRODUCT THICKNESS (FEET)
- (401.05) HYDROCARBON SURFACE ELEVATION
- NM NOT MEASURED
- INTERPRETED EXTENT OF FPH/LNAPL
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:

1. NO FPH PUMPING AT THE TIME OF MEASUREMENT WITH THE EXCEPTION OF RW-4A AND RW-5.
2. BAIL DOWN TESTS CONDUCTED SEPTEMBER 22-24, 2004.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
4. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

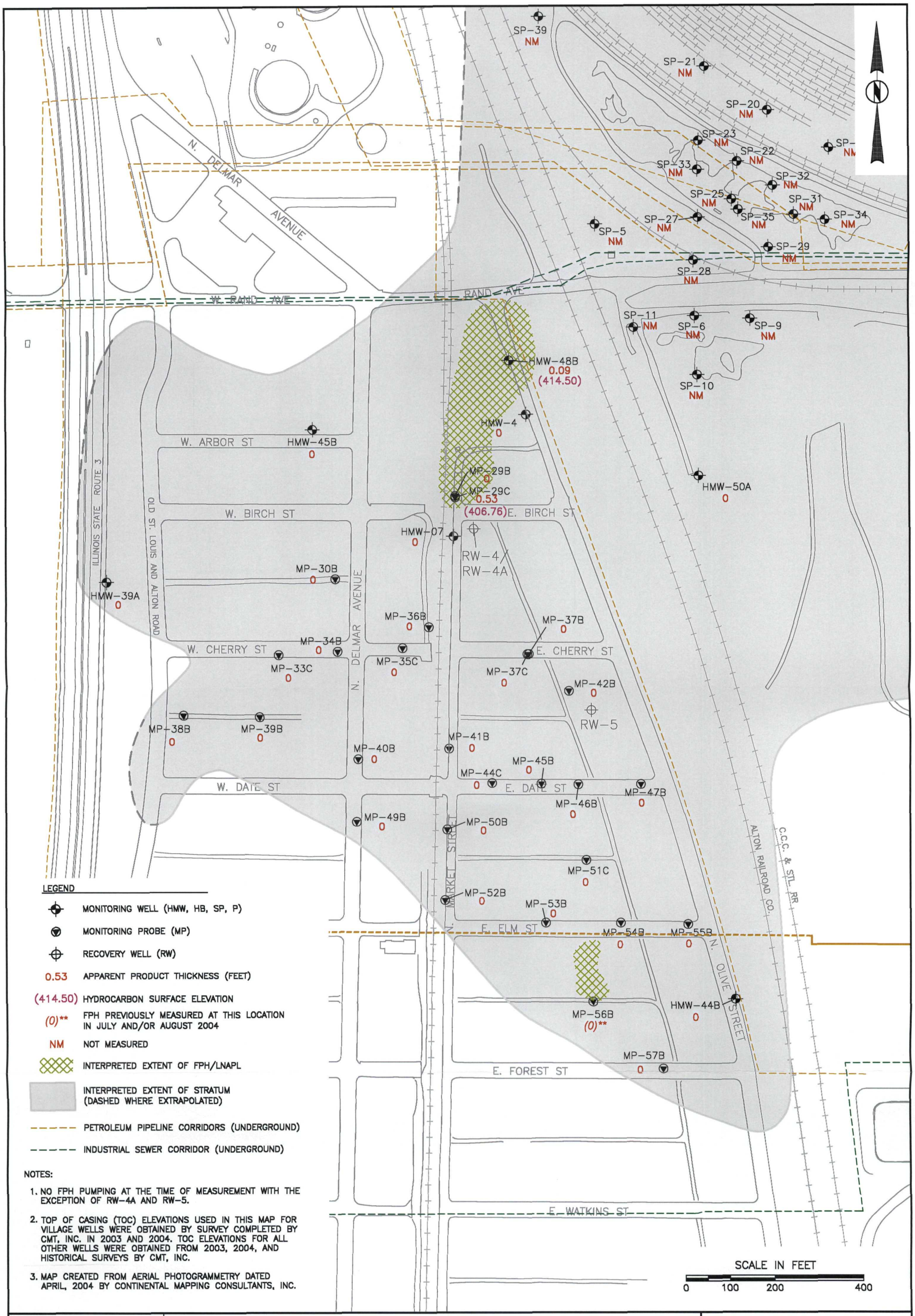
CHECK BY	KDC
DRAWN BY	BCP
DATE	10-15-04
SCALE	AS SHOWN
CAD NO.	0309514006H
PRJ NO.	15-03095

APPARENT FPH/LNAPL PRODUCT THICKNESS AND ELEVATION MAP
SEPTEMBER 20-22, 2004 - EPA STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE 6-2



LEGEND

- MONITORING WELL (HMW, HB, SP, P)
- MONITORING PROBE (MP)
- RECOVERY WELL (RW)
- 0.53 APPARENT PRODUCT THICKNESS (FEET)
- (414.50) HYDROCARBON SURFACE ELEVATION
- (0)** FPH PREVIOUSLY MEASURED AT THIS LOCATION IN JULY AND/OR AUGUST 2004
- NM NOT MEASURED
- INTERPRETED EXTENT OF FPH/LNAPL
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)
- PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
- INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)

NOTES:

1. NO FPH PUMPING AT THE TIME OF MEASUREMENT WITH THE EXCEPTION OF RW-4A AND RW-5.
2. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM 2003, 2004, AND HISTORICAL SURVEYS BY CMT, INC.
3. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

CHECK BY	KDC
DRAWN BY	BCP
DATE	10-29-04
SCALE	AS SHOWN
CAD NO.	0309514006i
PRJ NO.	15-03095

APPARENT FPH/LNAPL PRODUCT THICKNESS AND ELEVATION MAP
SEPTEMBER 20-22, 2004 - RAND STRATUM

THE HARTFORD HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

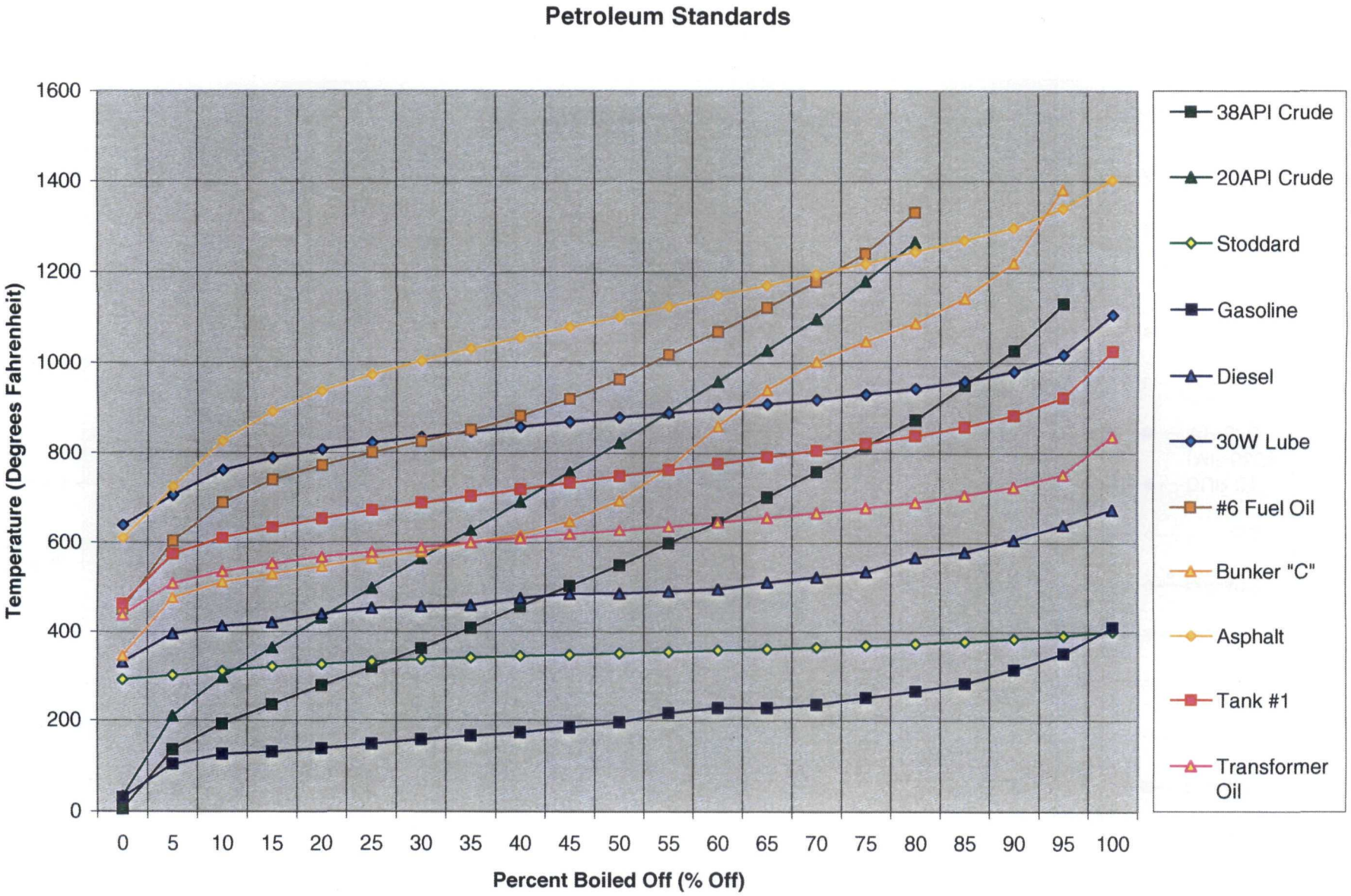
FIGURE 6-3

GRAPHS

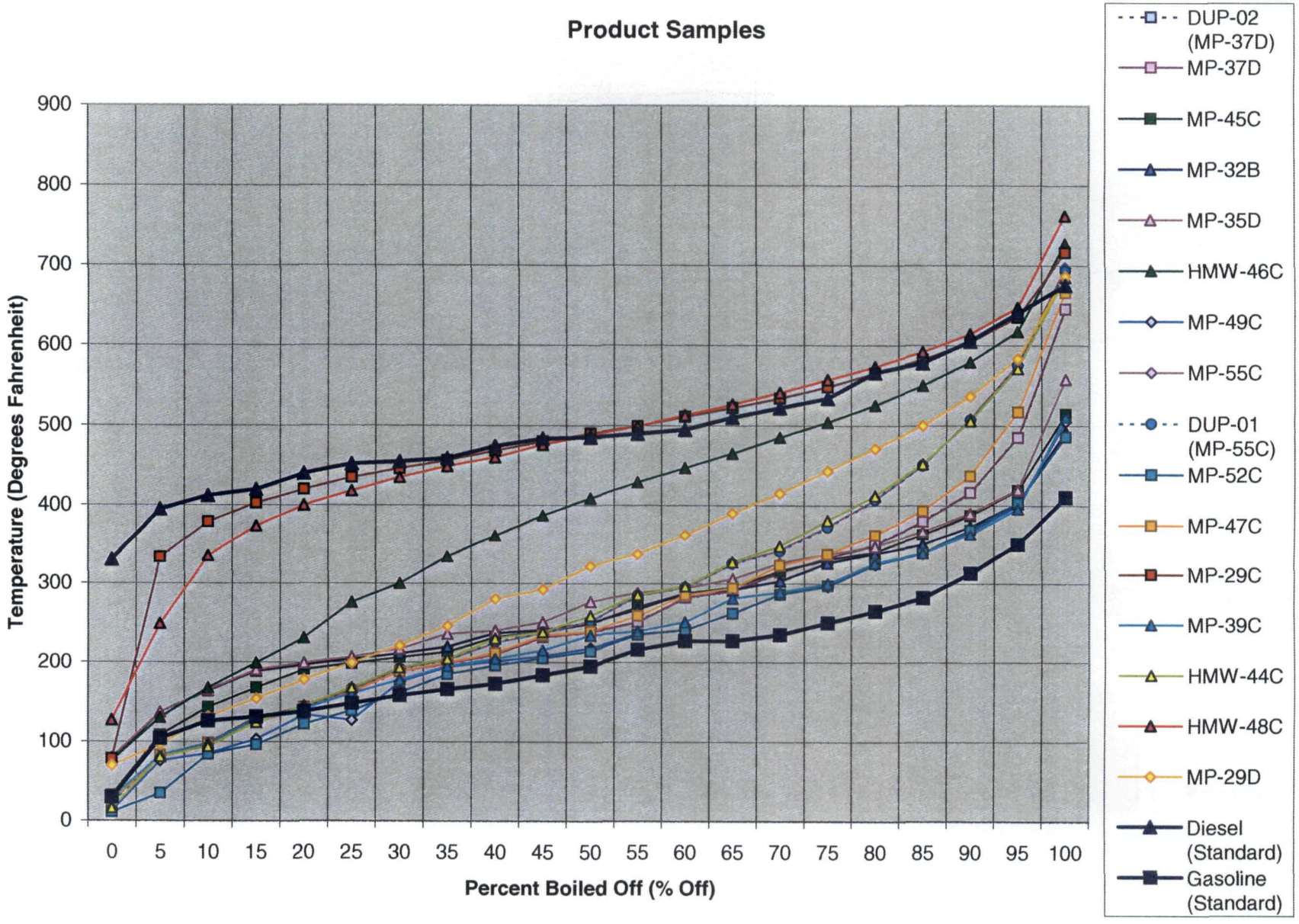
Clayton
GROUP SERVICES

FPH SIMULATION DISTILLATION GRAPHS

FPH Simulation Distillation Analysis

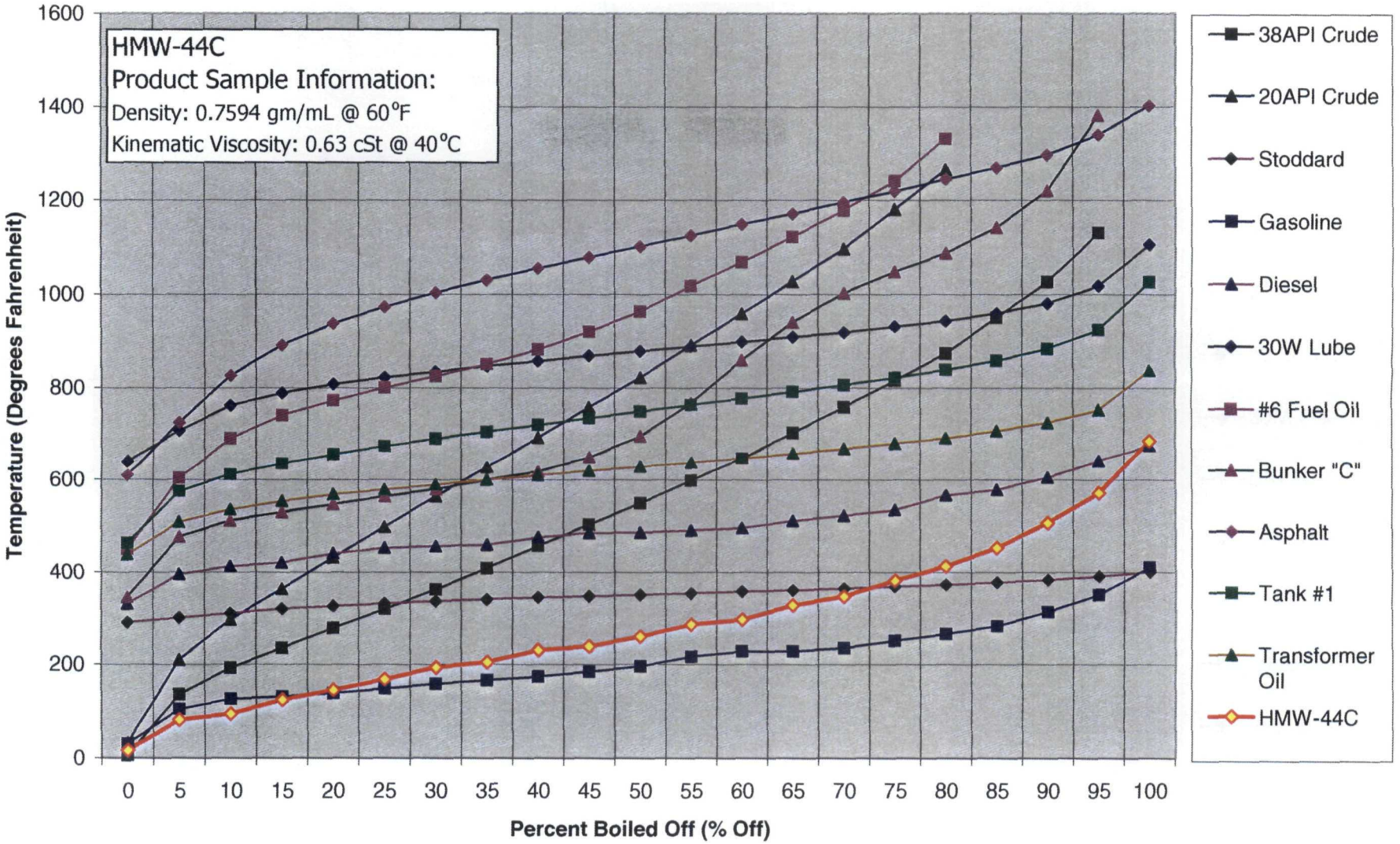


FPH Simulation Distillation Analysis



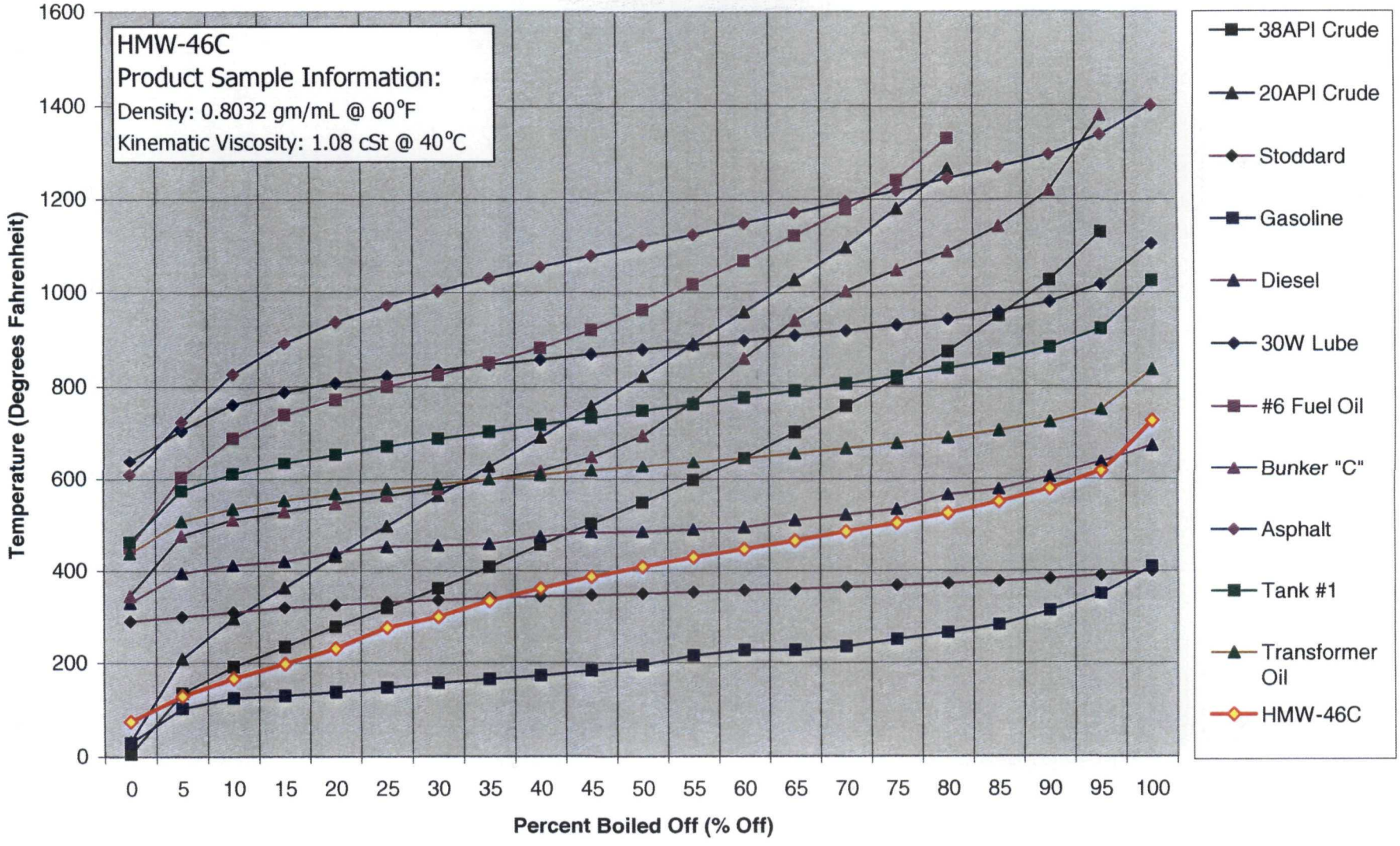
FPH Simulation Distillation Analysis

Sample Location: HMW-44C



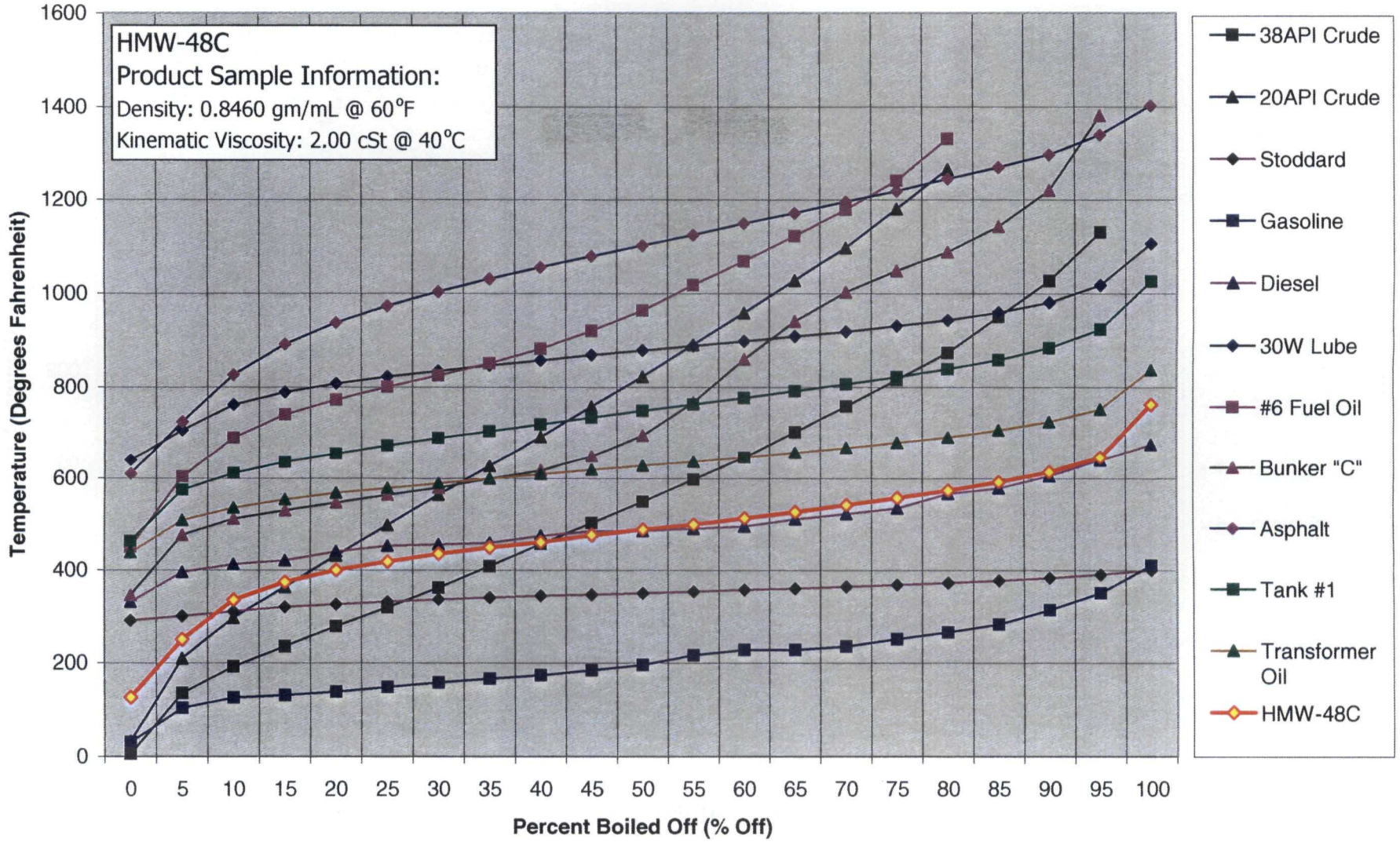
FPH Simulation Distillation Analysis

Sample Location: HMW-46C



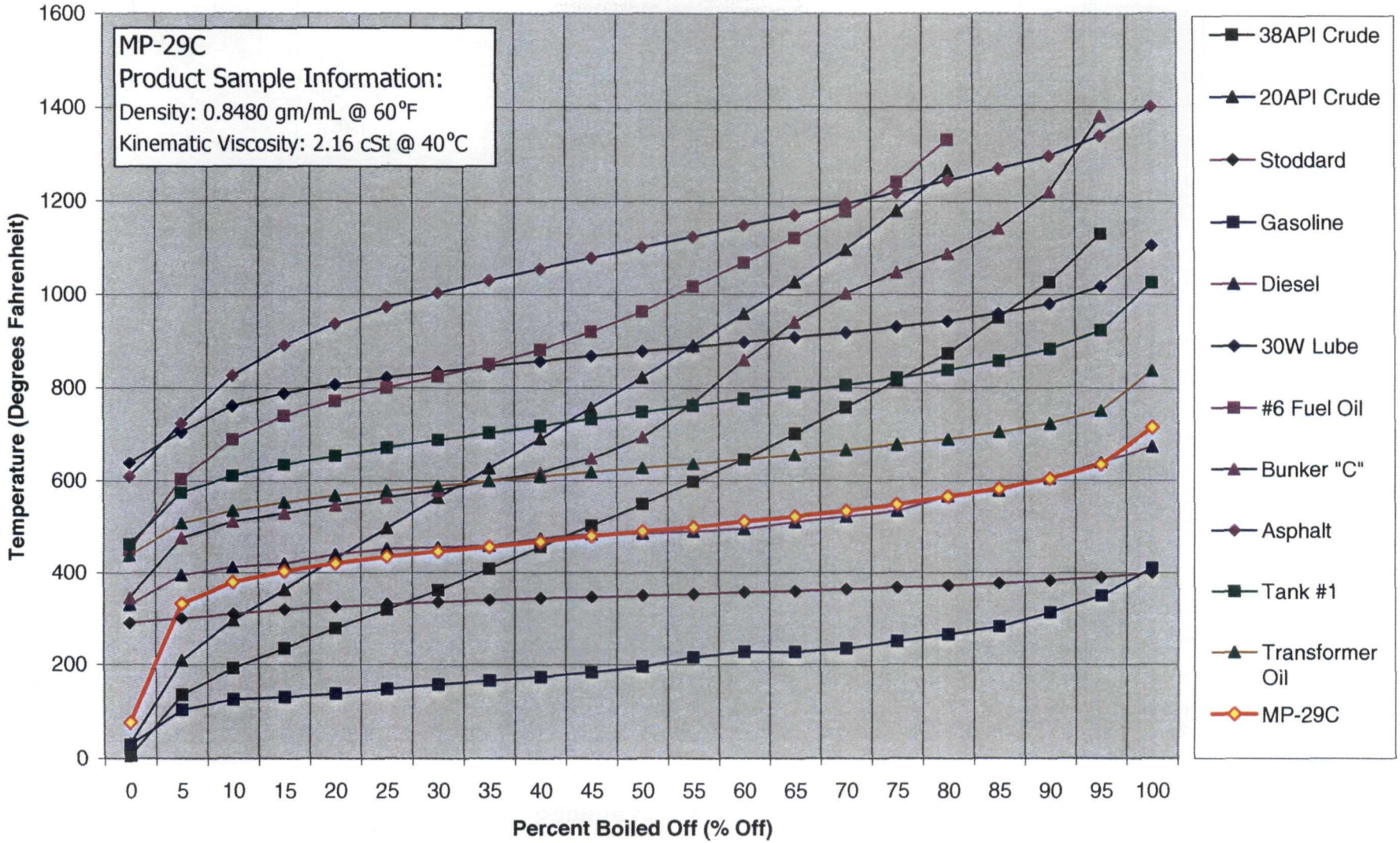
FPH Simulation Distillation Analysis

Sample Location: HMW-48C



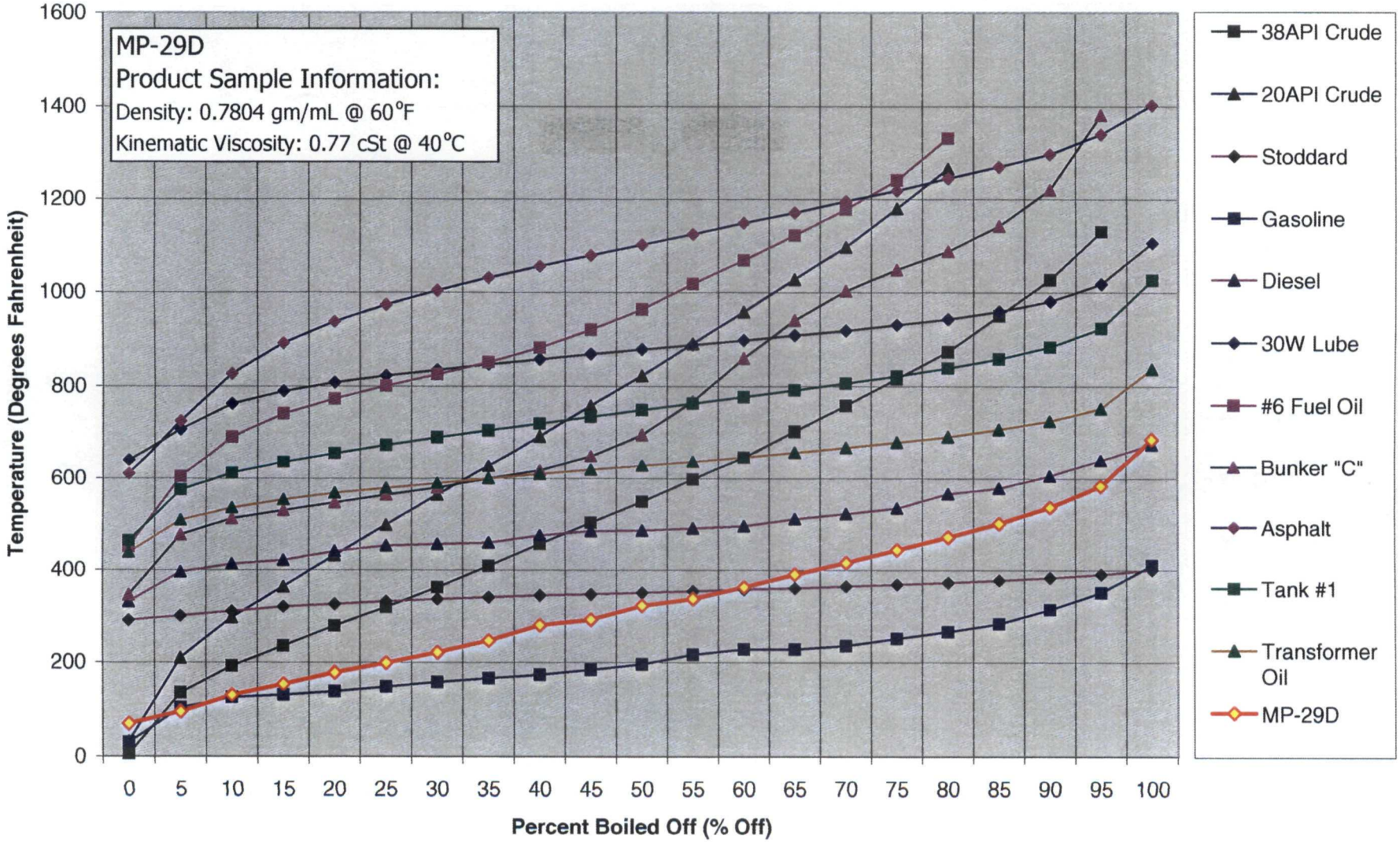
FPH Simulation Distillation Analysis

Sample Location: MP-29C



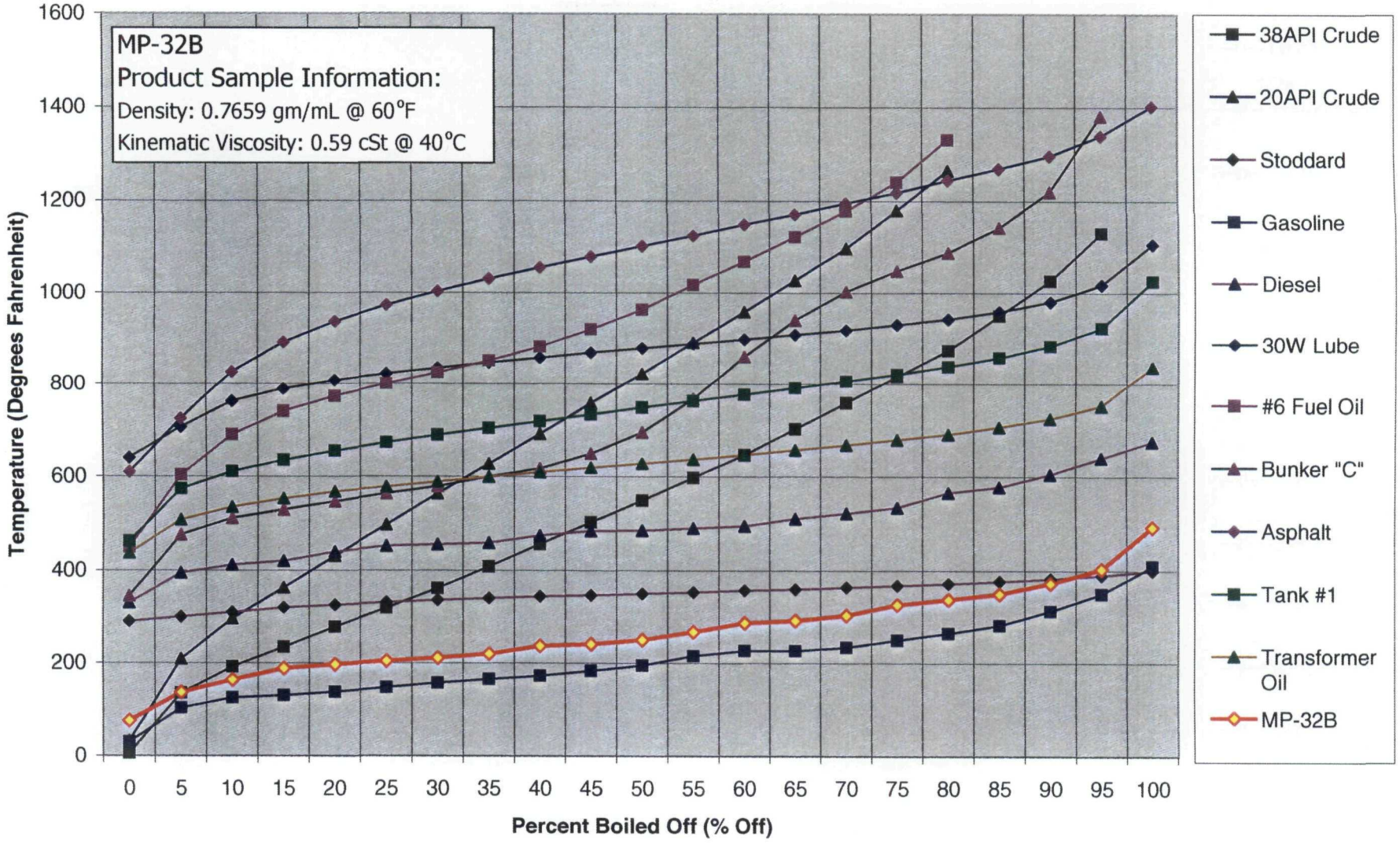
FPH Simulation Distillation Analysis

Sample Location: MP-29D



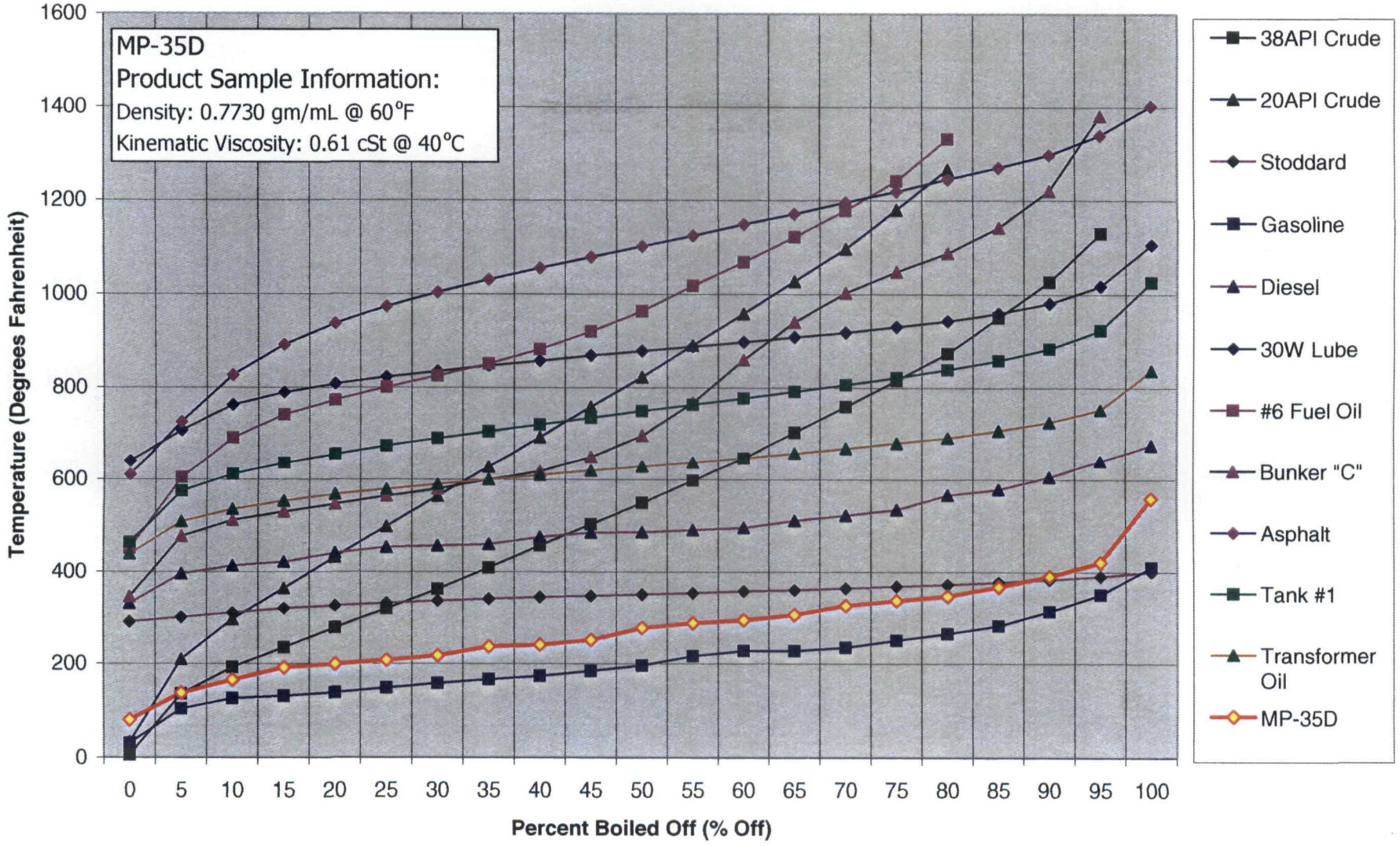
FPH Simulation Distillation Analysis

Sample Location: MP-32B



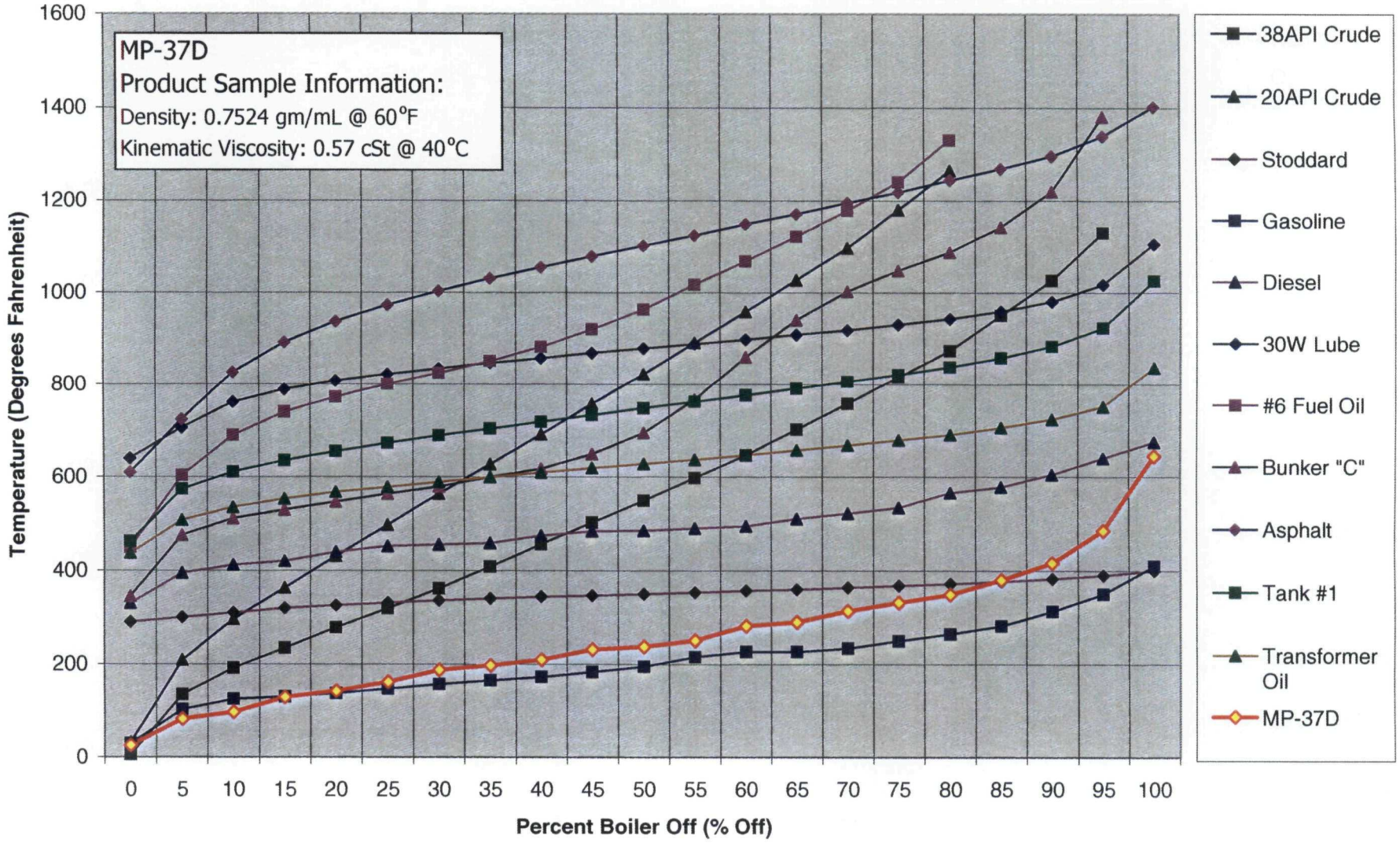
FPH Simulation Distillation Analysis

Sample Location: MP-35D



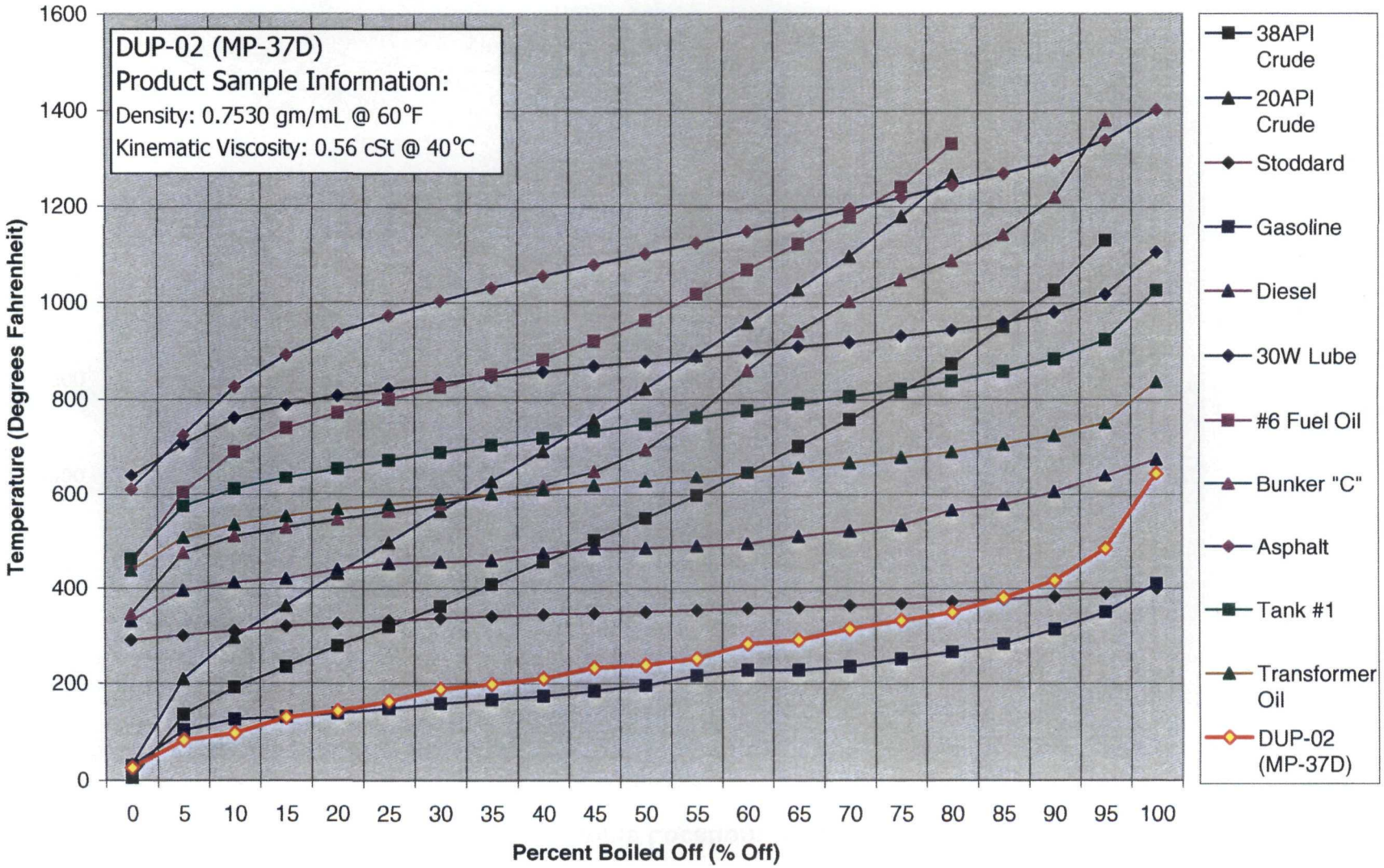
FPH Simulation Distillation Analysis

Sample Location: MP-37D



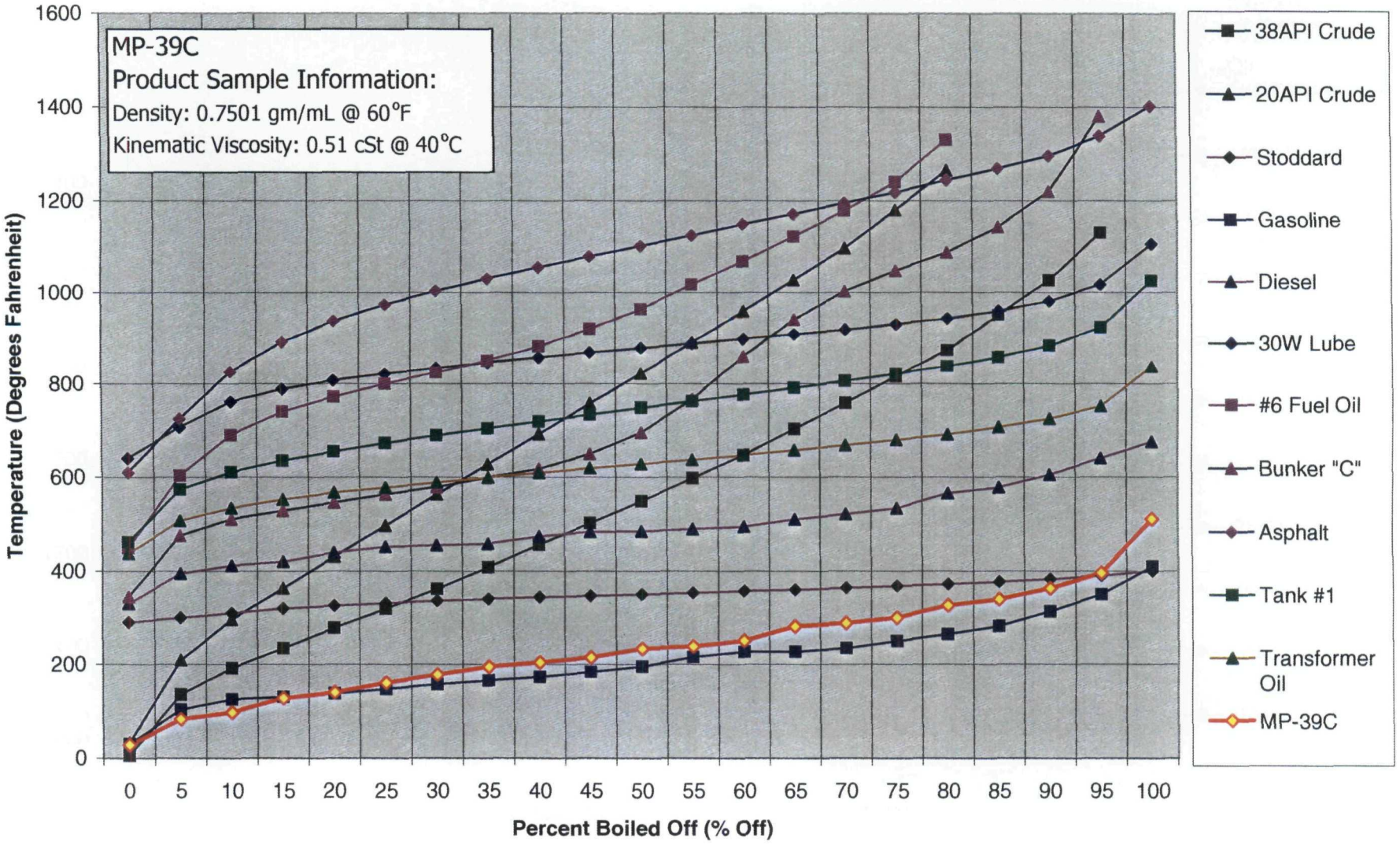
FPH Simulation Distillation Analysis

Sample Location: DUP-02 (MP-37D)



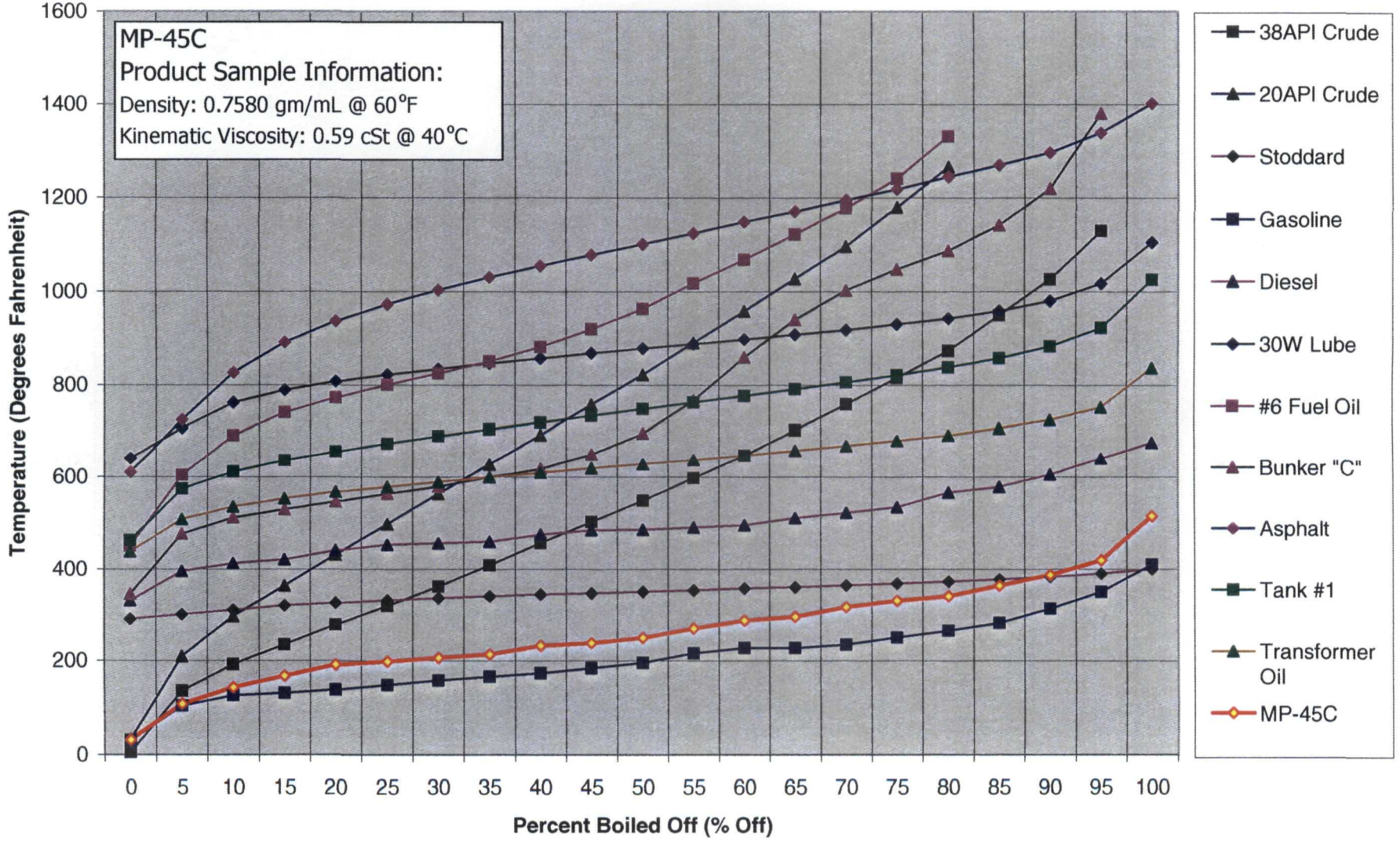
FPH Simulation Distillation Analysis

Sample Location: MP-39C



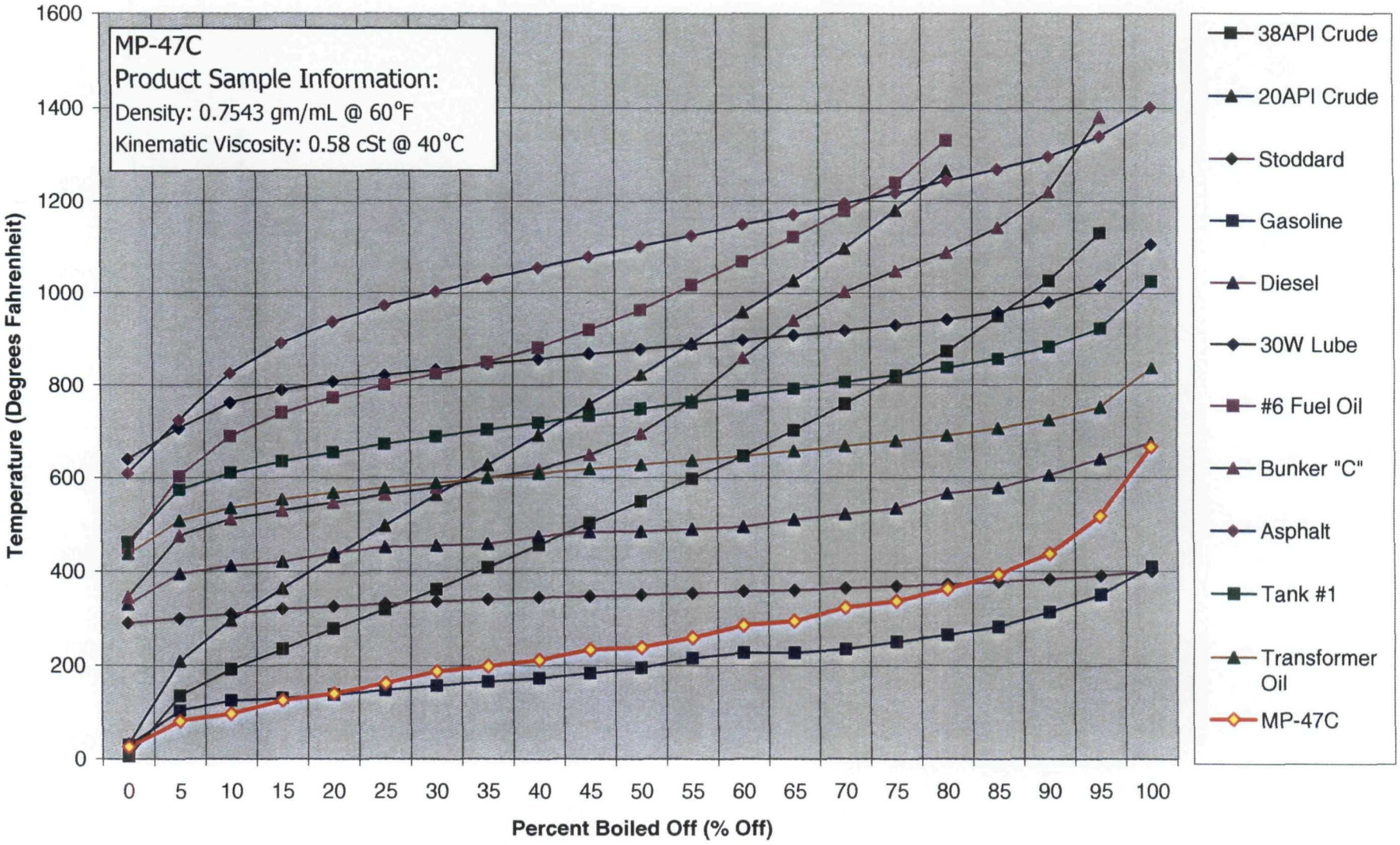
FPH Simulation Distillation Analysis

Sample Location: MP-45C



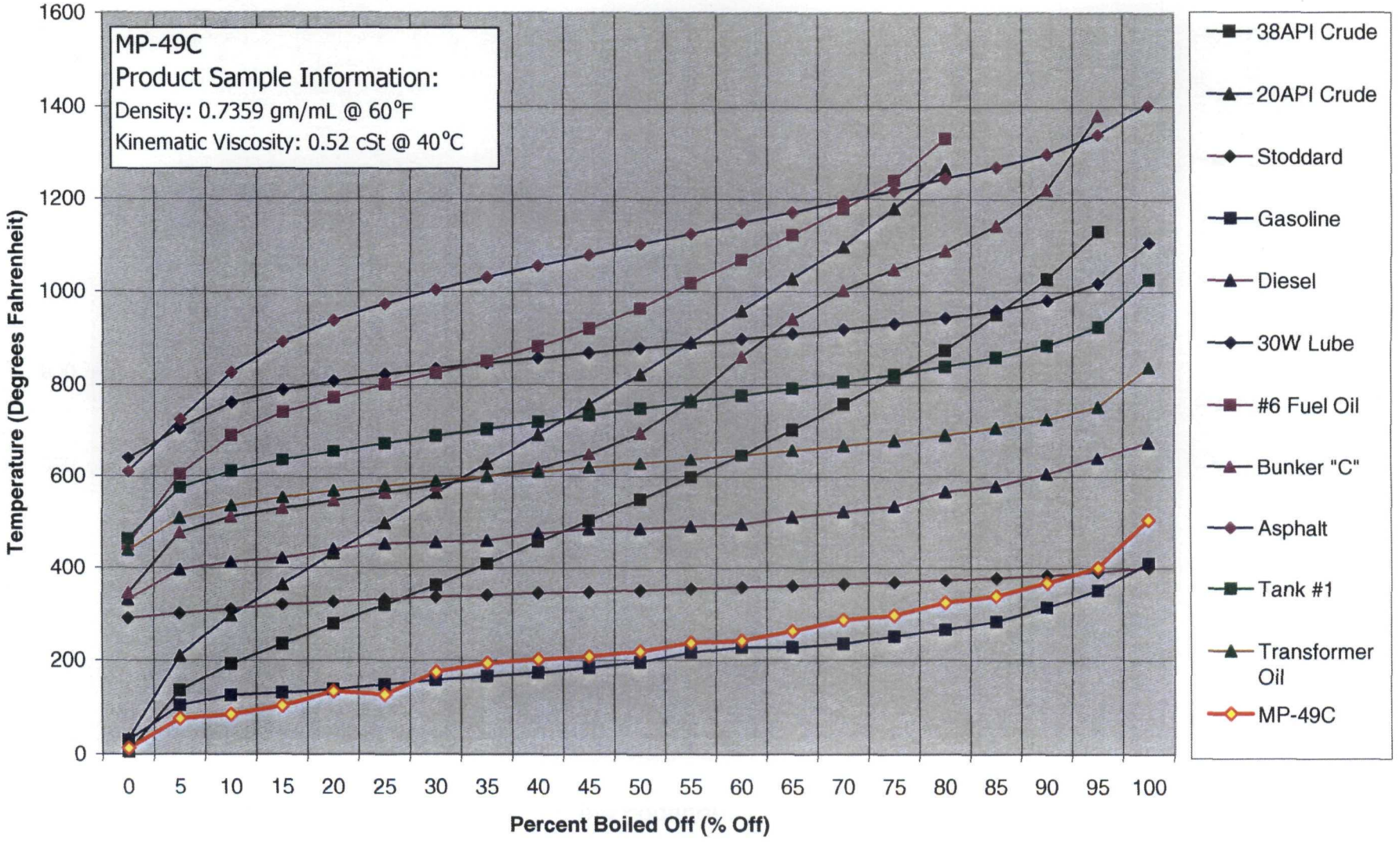
FPH Simulation Distillation Analysis

Sample Location: MP-47C



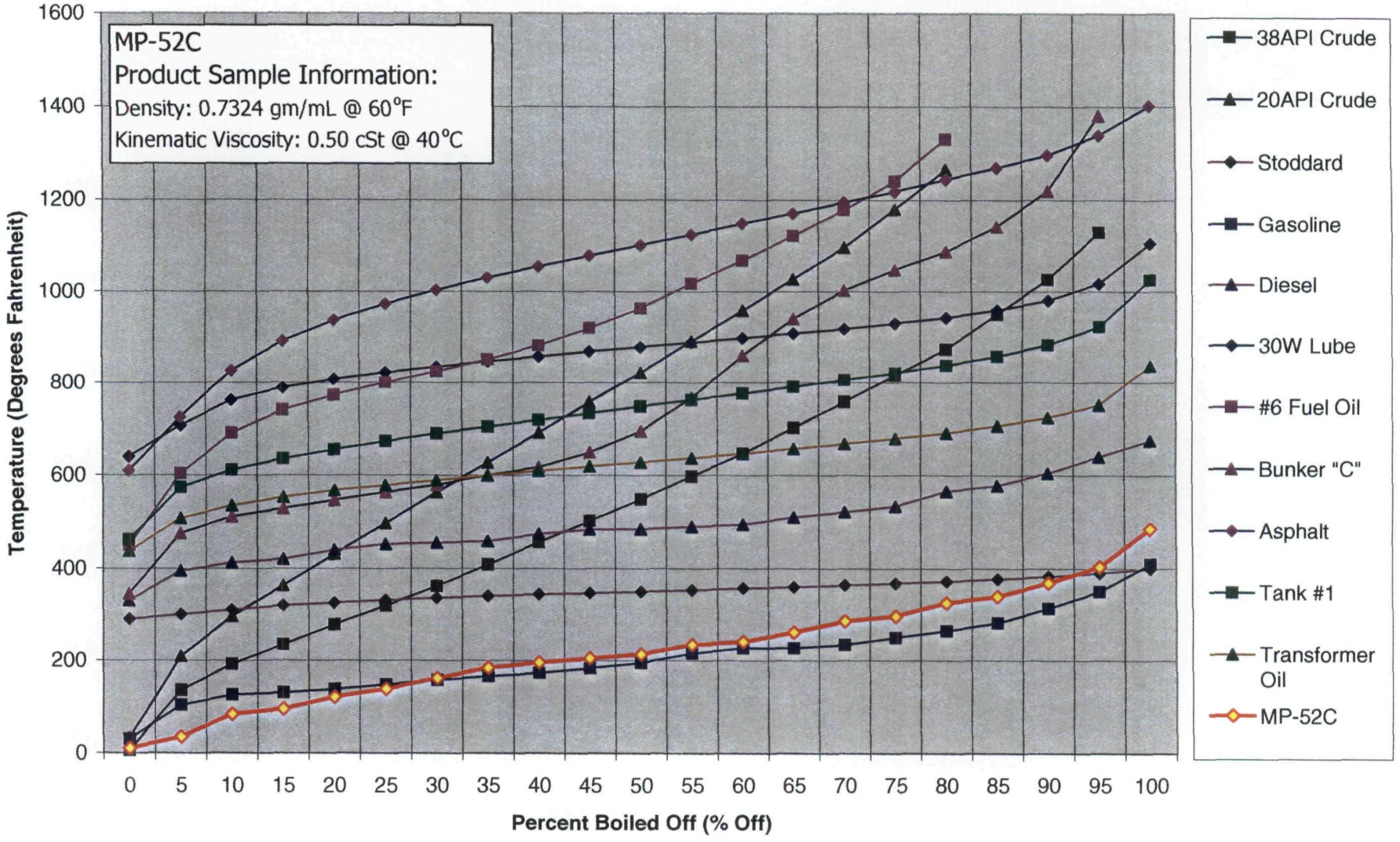
FPH Simulation Distillation Analysis

Sample Location: MP-49C

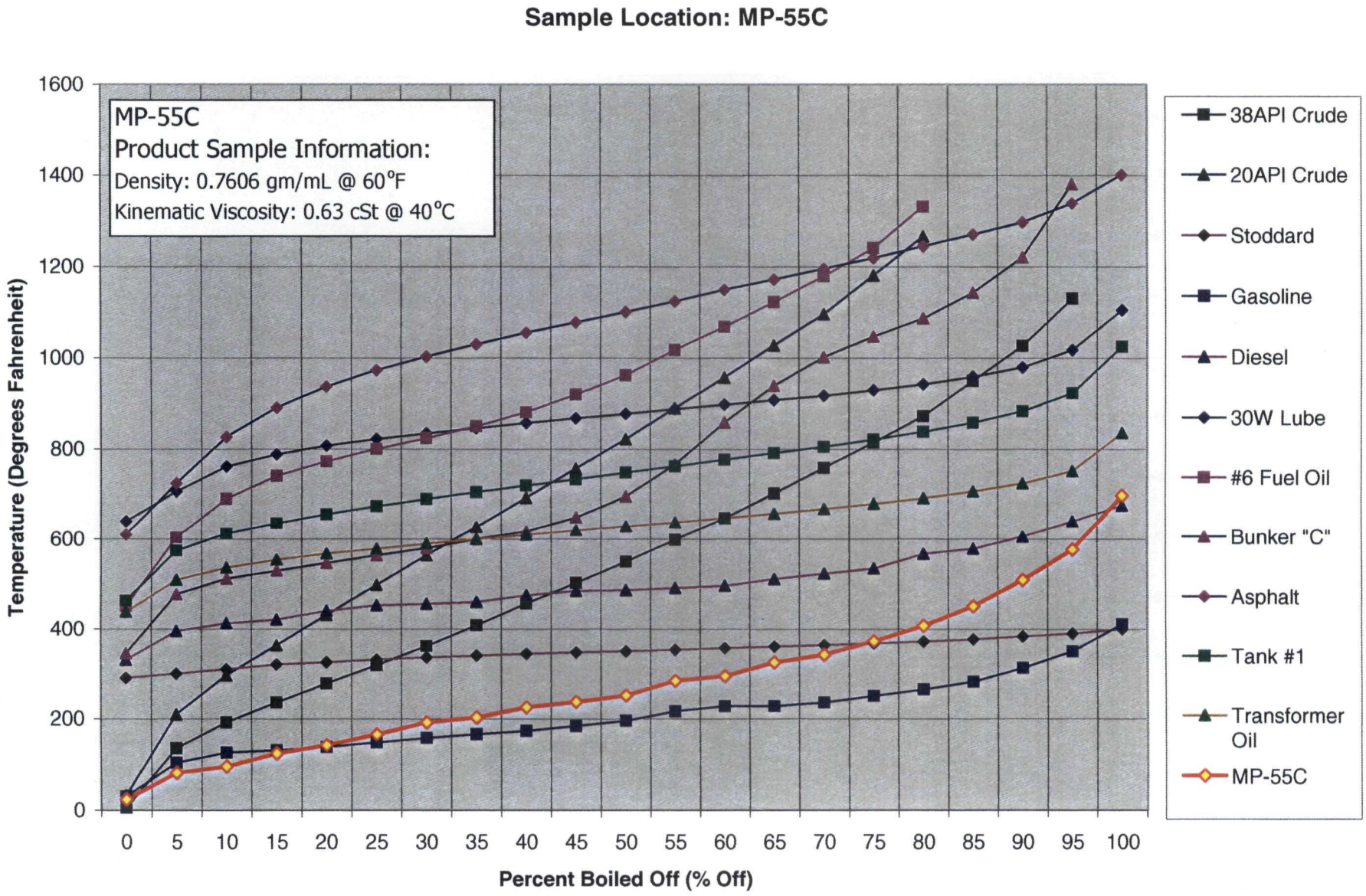


FPH Simulation Distillation Analysis

Sample Location: MP-52C

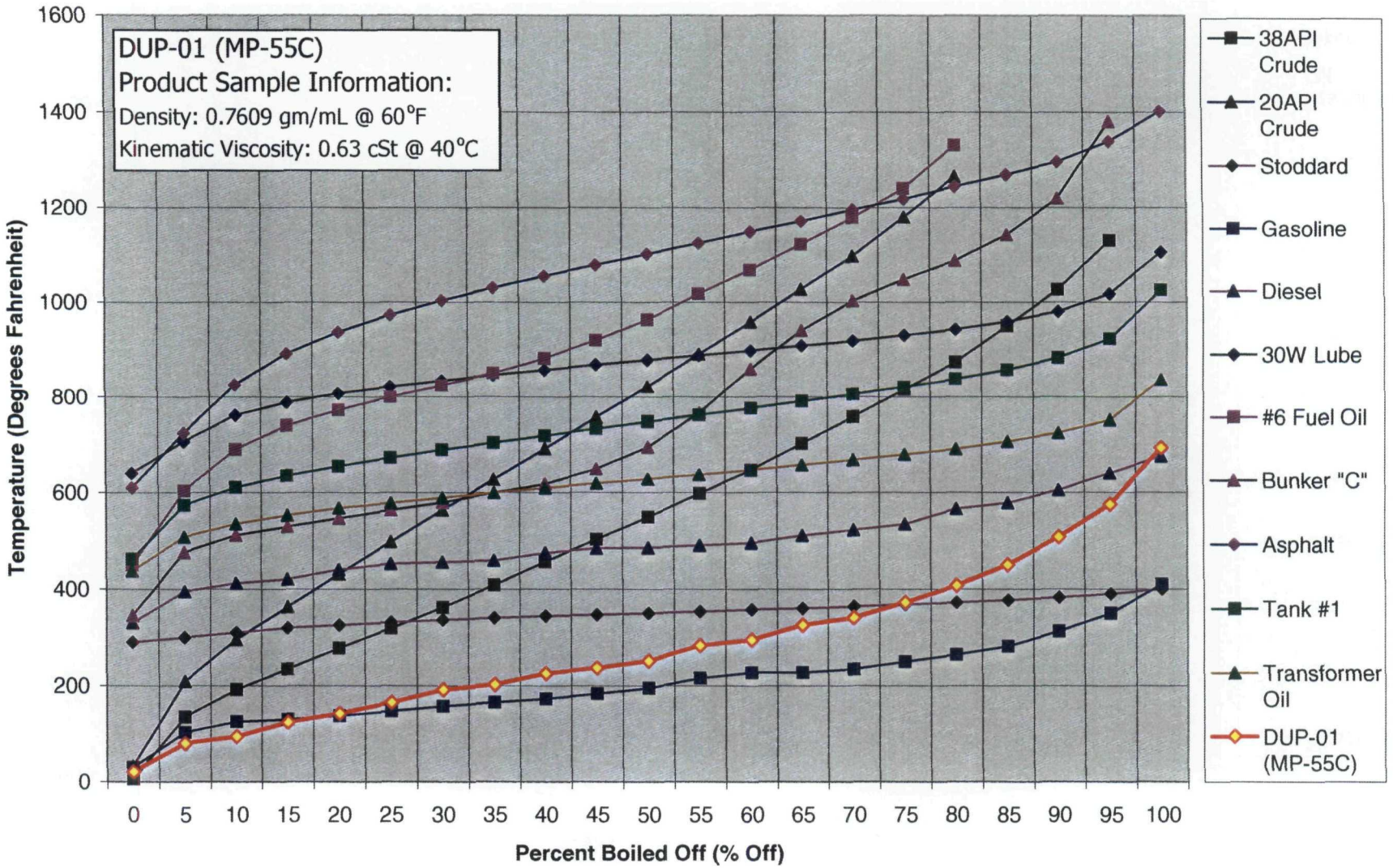


FPH Simulation Distillation Analysis



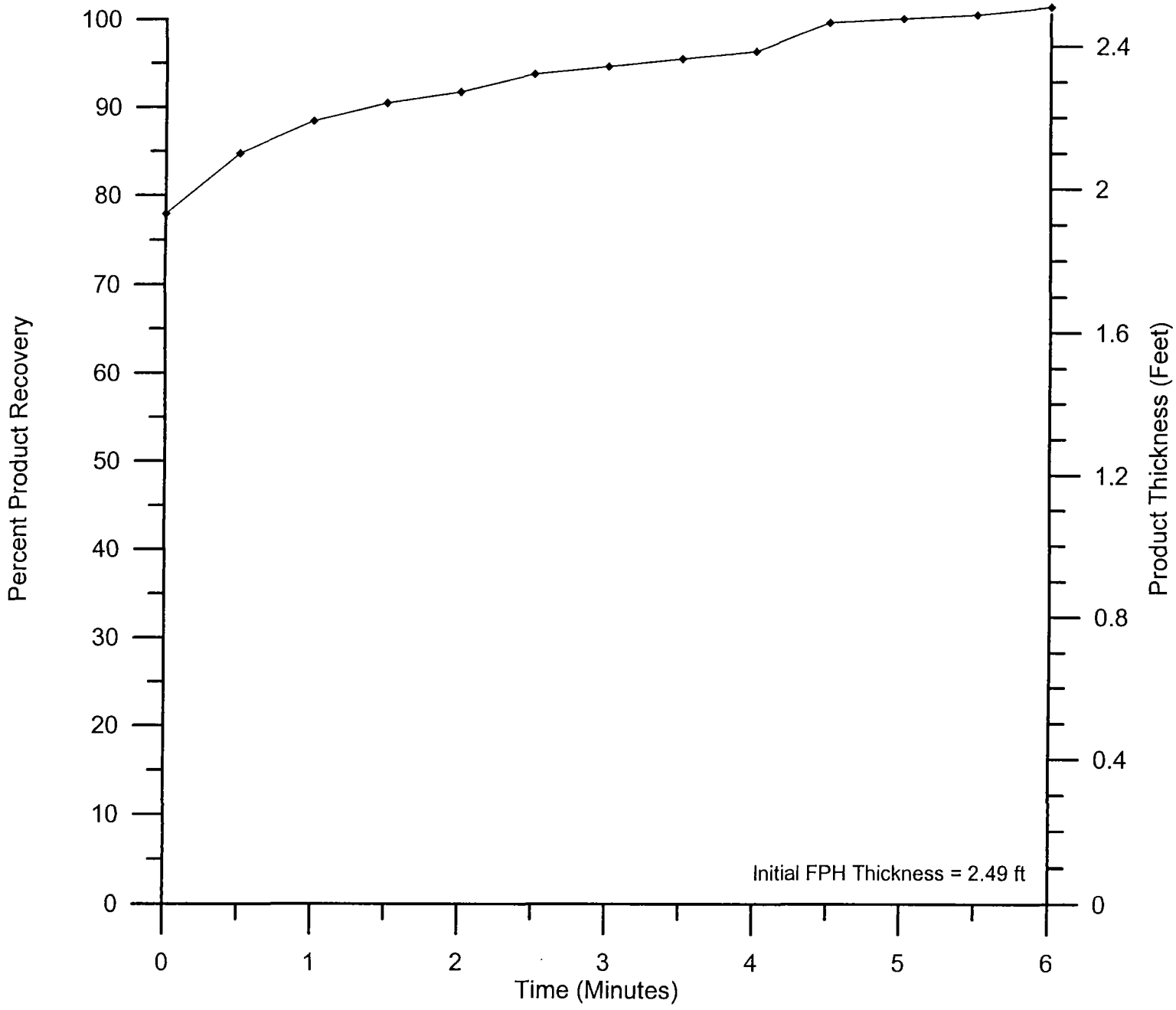
FPH Simulation Distillation Analysis

Sample Location: DUP-01 (MP-55C)

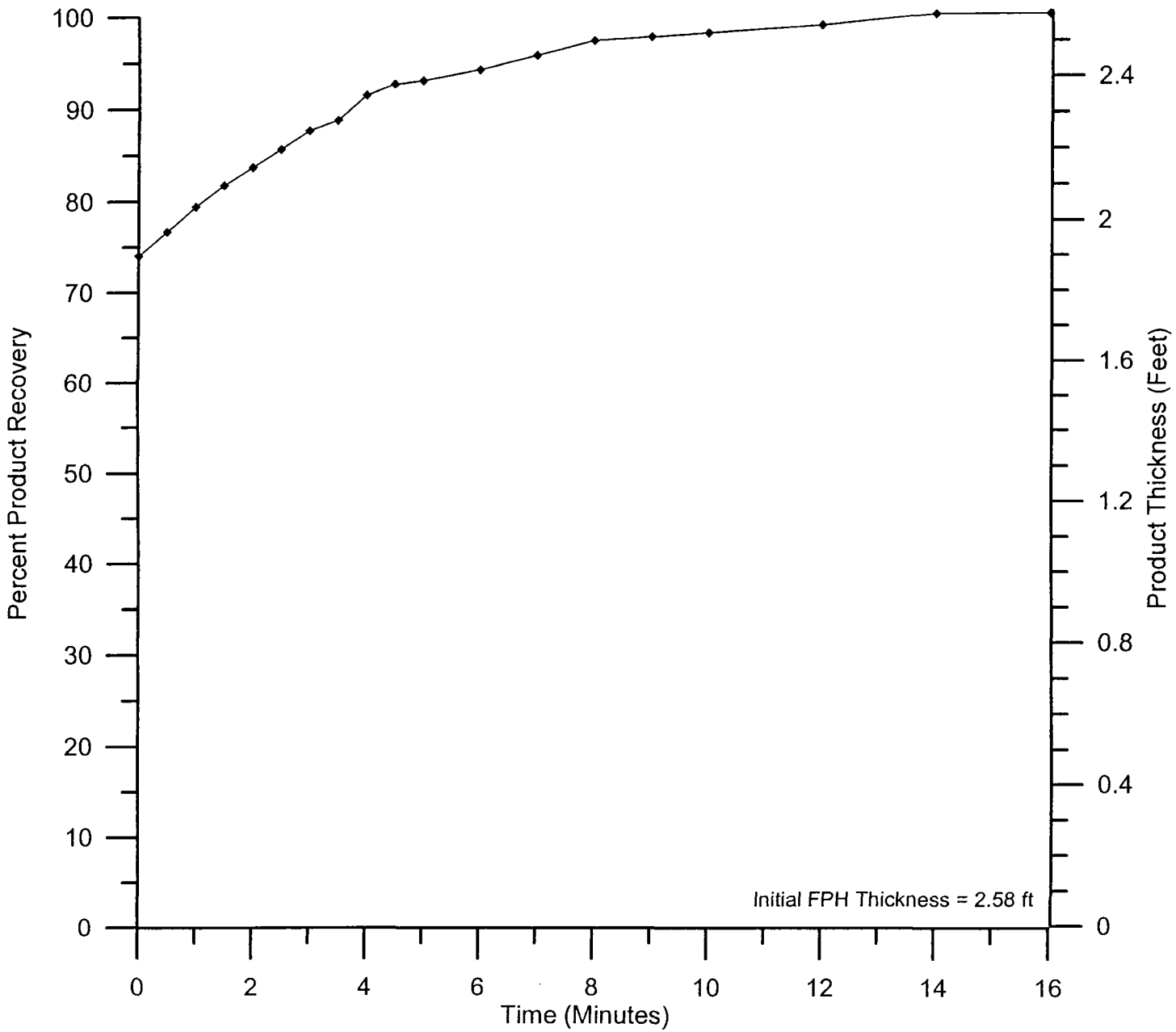


BAIL DOWN ACTIVITY GRAPHS

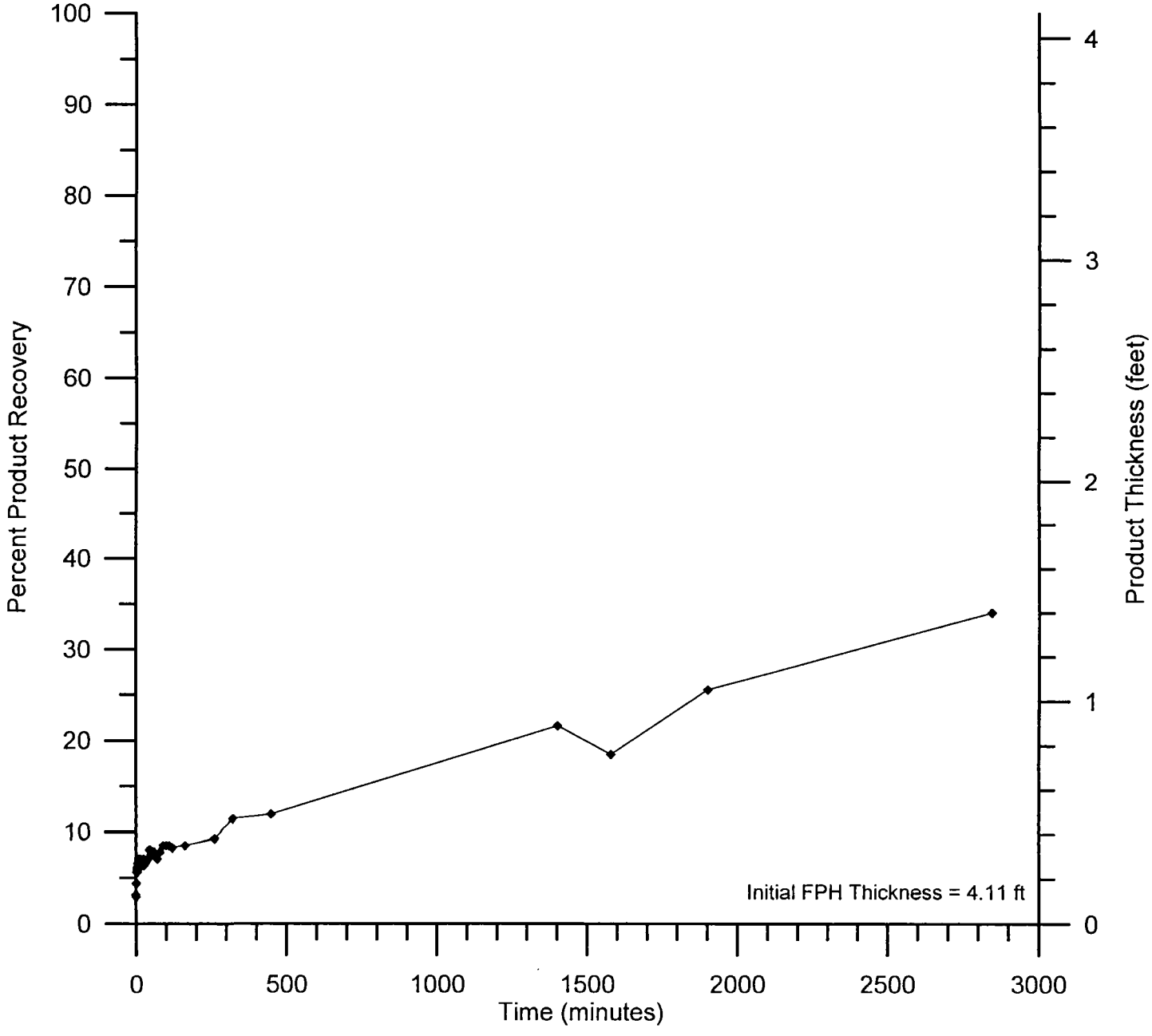
Percent Product Recovery vs. Time at HMW-44C



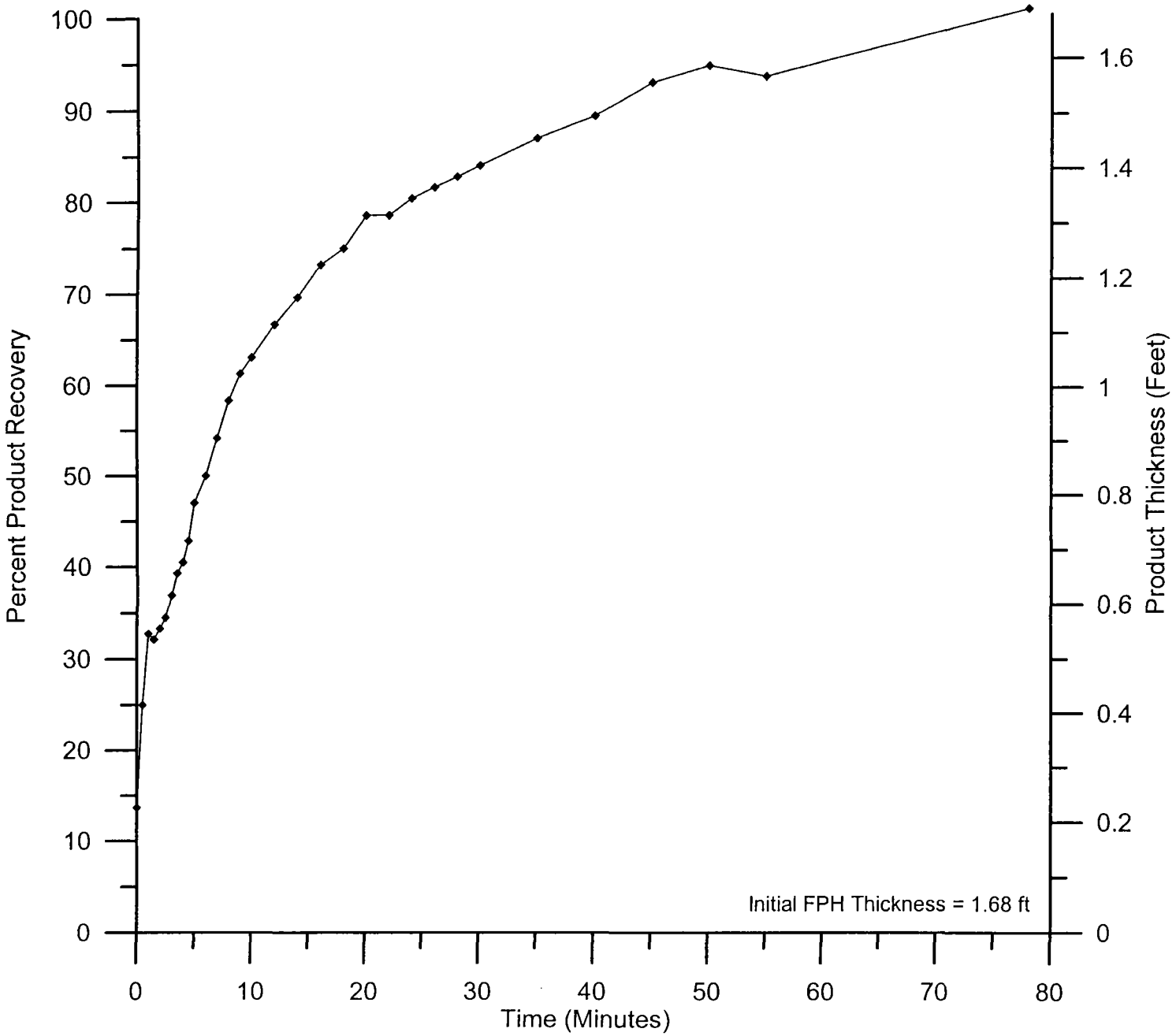
Percent Product Recovery vs. Time at HMW-44C(2)



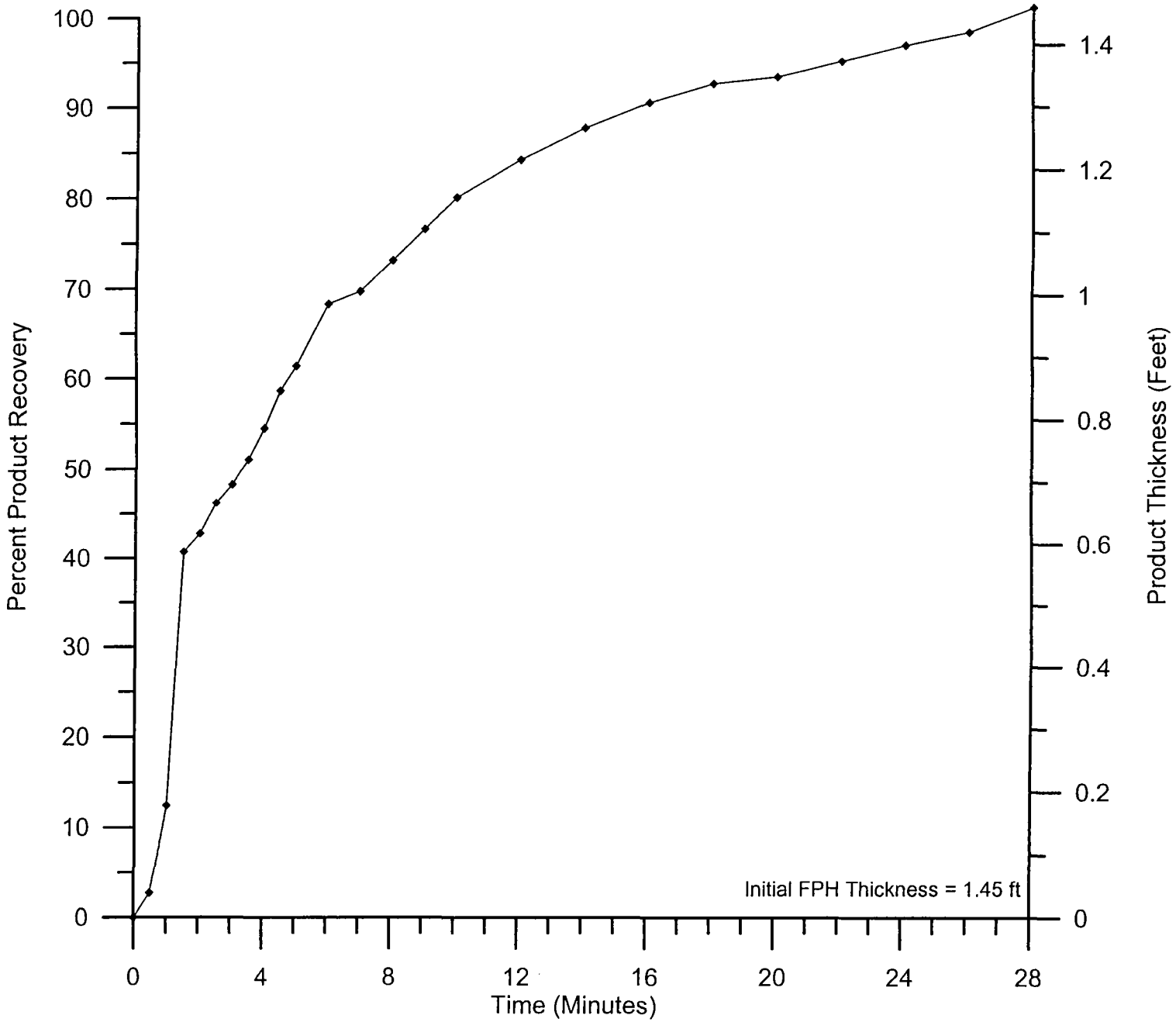
Percent Product Recovery vs. Time at HMW-48C



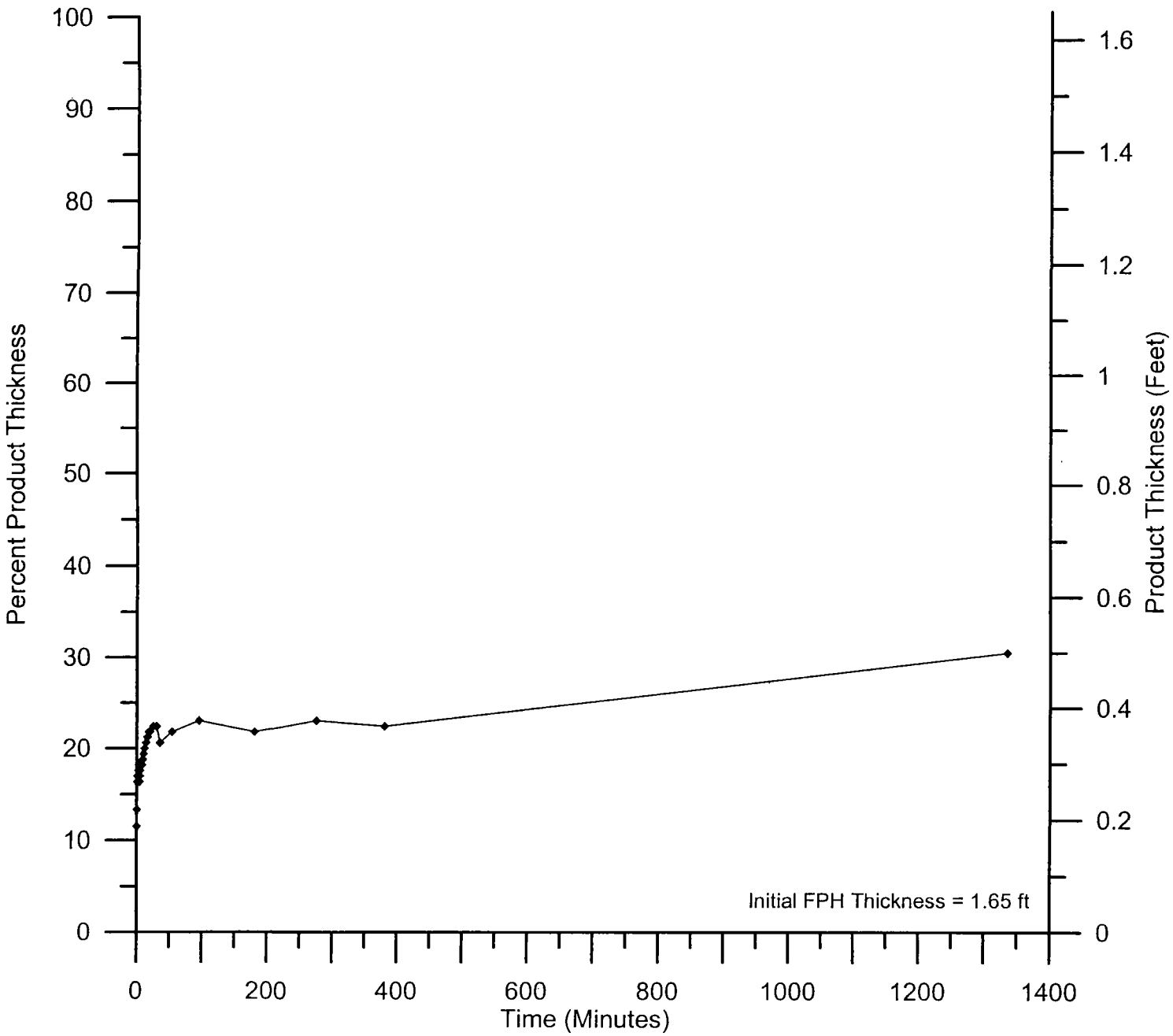
Percent Product Recovery vs. Time at MP-29D



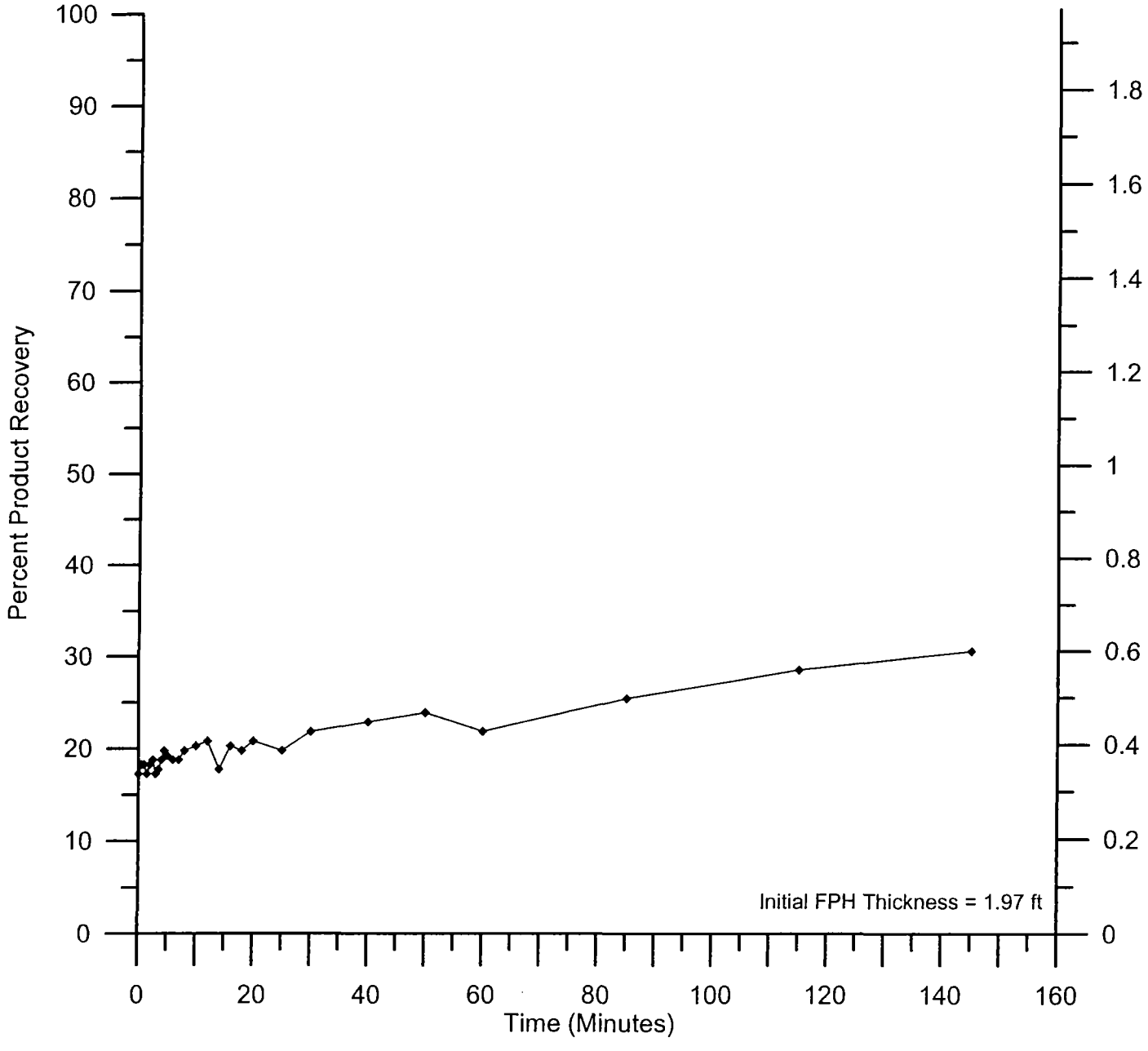
Percent Product Recovery vs. Time at MP-29D (2)

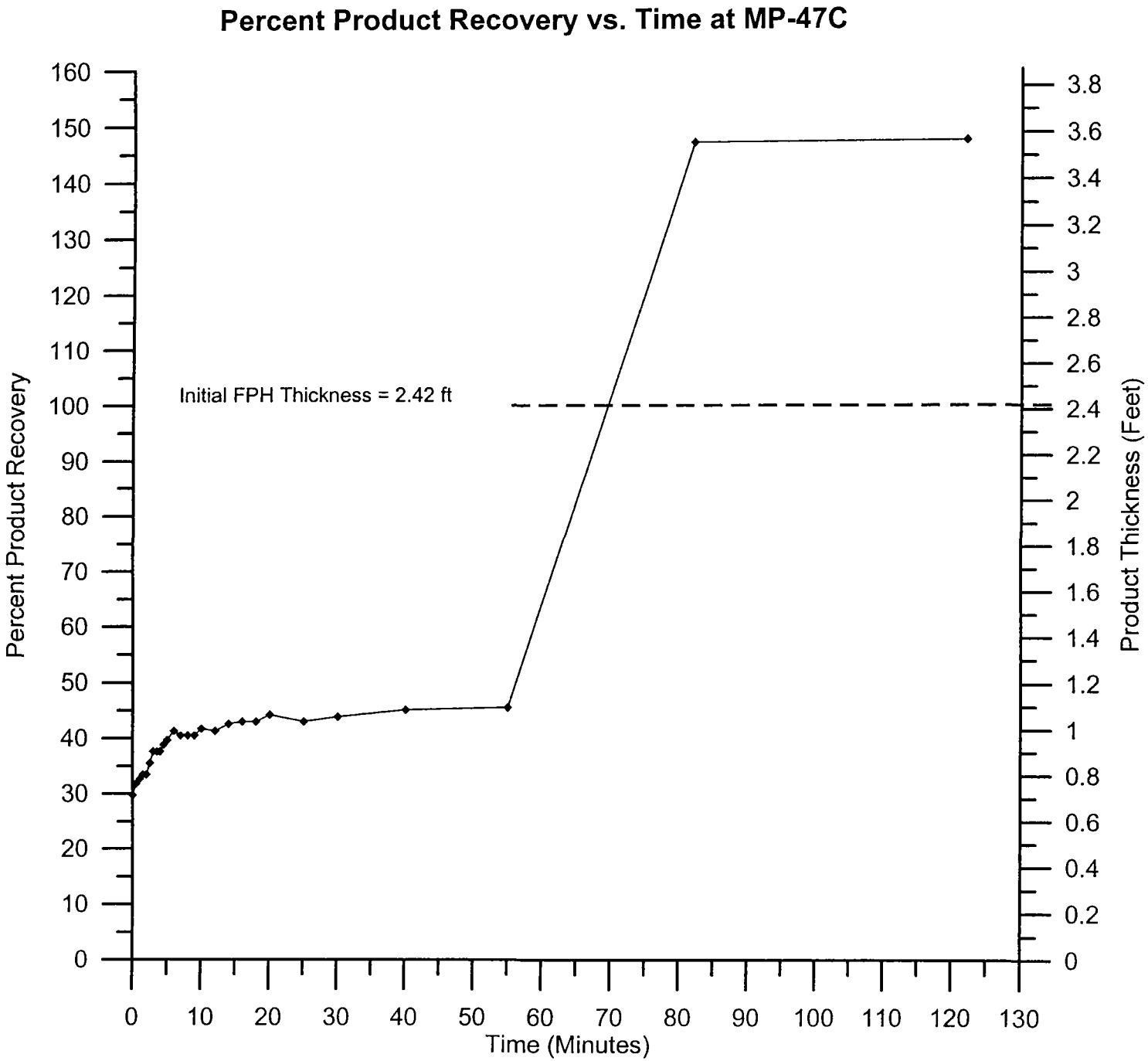


Percent Product Recovery vs. Time at MP-39C

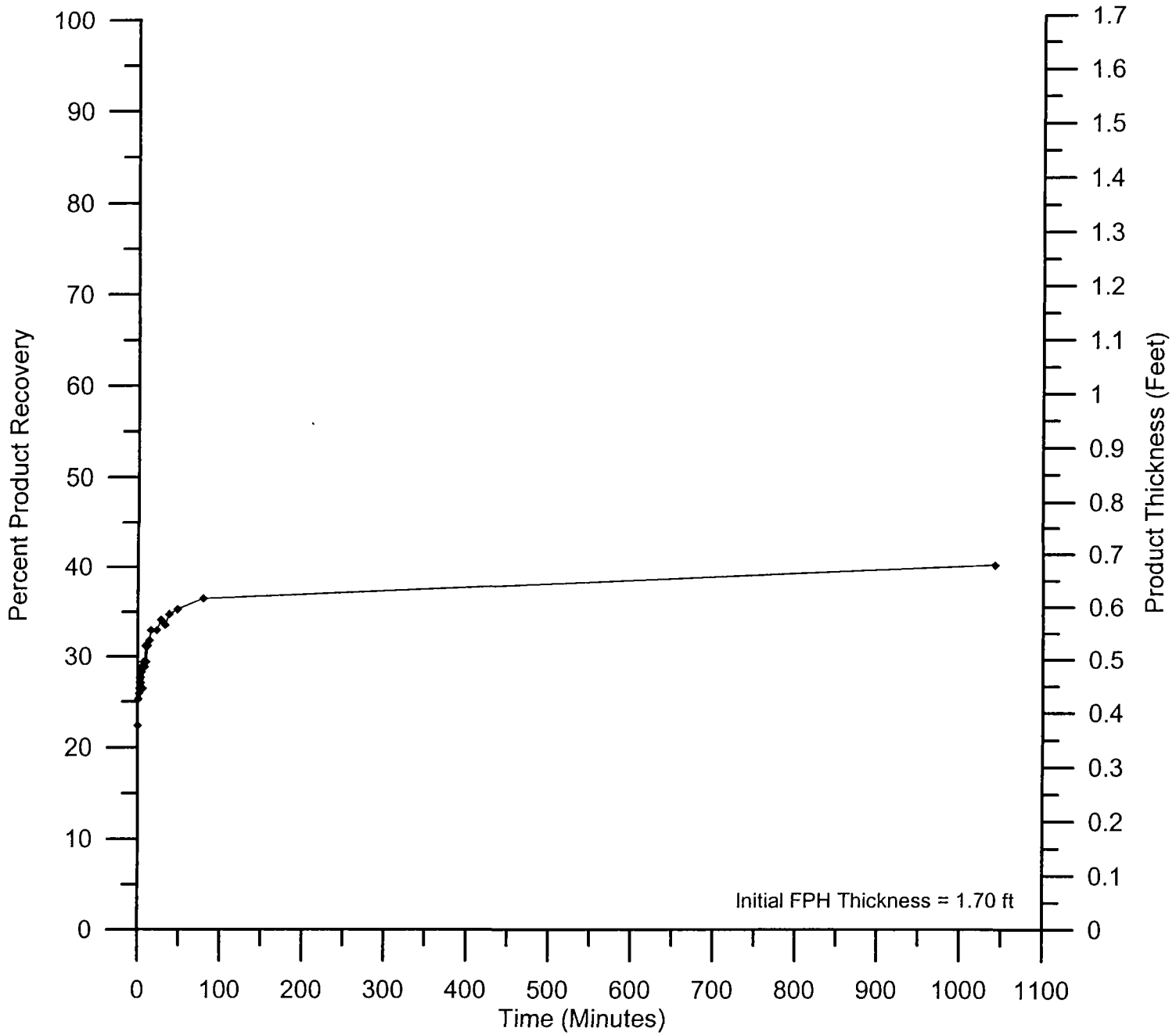


Percent Product Recovery vs. Time at MP-45C




Percent Product Recovery vs. Time at MP-47C
Initial FPH Thickness = 2.42 ft
Percent Product Recovery
Product Thickness (Feet)
Time (Minutes)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
80
90
100
110
120
130

Percent Product Recovery vs. Time at MP-53C



Percent Product Recovery vs. Time at MP-55C